TERRA

THE NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY
VOL. 23, NO. 6 • JULY/AUGUST 1985

FROM THE DIRECTOR

Last year at this time the Natural History Museum and all of Los Angeles were counting down to the beginning of the twenty-third modern Olympiad, the city's second in fifty-two years. The benefits from that extraordinary event will be with us for many years to come. The Olympic games were good for Los Angeles, and Los Angeles was good for the games and the entire Olympic movement.

The Olympic Games provided the impetus for badly needed renovations at the Natural History Museum and offered the museum the opportunity to obtain the necessary funds to accomplish them. The Game's benefits are tangibly represented by the renovated Governor's Gallery for special exhibitions, the cleaned and restored east entrance of the museum, which opens onto the Rose Garden, and the redecorated Times-Mirror meeting rooms below the auditorium.

However, the impact of the Games did not end with the closing ceremonies last August or with the dismantling of the museum's special Olympic exhibitions in September. We are currently working on several additional building projects and a new special exhibition, all of which are still tied directly to the success of the 1984 Olympics. The building projects include the preliminary engineering studies to air-condition the entire original museum building and a restructuring of office space at the south entrance.

In August a major retrospective exhibition on the 1984 Games will open in the museum for a three-month run. This exhibition deals with all aspects of both the process of staging the Games and the actual competitions themselves. Film, videodisc, interactive computer games as well as the paraphernalia of the events and the venues will re-create and recall the marvelous events of last summer.

To help provide for this exhibit, the LAOOC awarded the Natural History Museum a grant of $1,000,000 to renovate a second major special exhibition gallery, to be known as the Olympics Gallery, and to stage the exhibition itself. The museum has also been chosen as a major repository for 1984 Olympic memorabilia just as it was in 1932. With this material we expect to present a special exhibition on the Olympics every four years.

Thus, the legacy of the 1984 Games will be an enduring one, and its benefit to Los Angeles and to the museum will be long remembered.

Craig C. Black

CURATORS & COLLECTIONS

OLYMPIC TORCH RELAY CAR ADDED TO AUTOMOTIVE COLLECTION

Designed for sustained slow-speed operation, the 1984 Buick Olympic Torch Relay Car is equipped with such unique features as a complete radio communication console and rear-deck camera mount. An all-inclusive spare parts kit was kept in the trunk. Sam the Eagle optional.

The 1984 Olympic Torch Relay Car, a turbocharged Buick Riviera convertible specially designed and outfitted to serve as the pace car for the eighty-four-day coast-to-coast journey of the Olympic flame, was presented to the museum by the Buick Motor Division of General Motors Corporation.

The museum's Director, Dr. Craig C. Black, accepted the keys to the car from Michael S. Hadden, Buick's Los Angeles Zone Manager, in a brief ceremony held at the museum's north entrance on April 16. The Olympic Torch Relay Car, which is the most modern vehicle in the museum's growing collection, is on display in the automobile gallery located at the ground floor of the Natural History Museum.

MUSEUM HOSTS ASSOCIATION OF SYSTEMATICS COLLECTIONS

From May 22 to 24 the Natural History Museum of Los Angeles County hosted the annual meeting of the Association of Systematics Collections. In addition to the business meeting, this year's events included a two-day symposium and public forum on the proposed National Biological Survey, a topic currently being

(Continued on page 30)

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THE MEMBERS' MAGAZINE
OF THE NATURAL HISTORY MUSEUM
OF LOS ANGELES COUNTY
AND THE PAGE MUSEUM
OF LA BREA DISCOVERIES

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COVER

Sam the Eagle, official mascot of the 1984 games, will be on hand at the museum to welcome visitors to the Olympics Retrospective Exhibit opening. Sam modeled by John Cahoon. Photograph by John De Leon.

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EL NIÑO AND CHRISTMAS ISLAND

Where Did All the Birds Go?

by RALPH W. SCHREIBER
and ELIZABETH ANNE SCHREIBER

Photographs
by the Authors

Previous page: Adult Sooty Terns flying over their nesting colony. In November 1982 the authors expected to find many individuals of this species swirling over nesting locations in preparation for the laying season. Because of El Niño, they neither saw nor heard any.

Juvenile Great Frigatebird waiting for its parents to return with fish or squid for its evening meal.

A juvenile Great Frigatebird attempts to steal a fish from a local fisherman's net.

On a research visit to Christmas Island in the Central Pacific Ocean (2 degrees north latitude, 157 degrees west longitude) in November 1982, we discovered, to our consternation, that virtually all the normal population of eight to twelve million birds had disappeared. Chicks, which could not fly, were left to starve, and the flat coral atoll was flooded with unusual rains. We were soon to learn that the worst El Niño in recent history was in full force.

El Niño is the periodic (every three to ten years) appearance of uncharacteristically warm water in the eastern Pacific Ocean off the coasts of Ecuador and Peru and sometimes extending across the equatorial Pacific. It occurs in response to a change in high and low pressure zones in the Pacific. While the causes of this warming remain unknown, the meteorological and physical oceanographic results of El Niño—warm ocean waters and the resultant lack of nutrients, unusually and unseasonally heavy rains or, conversely, drought—are reasonably well understood. The biological consequences are less well known.

We knew that El Niño affected seabirds along the coasts of Ecuador and Peru, but this is the first time its effects were noted on Christmas Island. Periodic visits to the island since then have revealed a drastic decrease in populations of most seabird species and alterations in their reproductive efforts.

Seabirds' breeding characteristics (one large egg, long incubation period, extended parental care, the feeding of juveniles after they have acquired their flight feathers, deferred maturity, long life-span) indicate that these open sea foragers depend on a distant, limited, or ephemeral food supply of small fishes and squid. Seabirds rely to a large extent on predator fishes and marine mammals to drive smaller fishes and squid toward the ocean surface. Populations of seabirds are thought to be restricted by low food availability in these open sea feeding zones. Our information on the seabird community of Christmas Island collected before the 1982–83 El Niño and combined with studies that we now continue after the onset of these unusual ocean-atmosphere interactions provide insight into how these interactions affect the upper levels of the marine ecosystem.

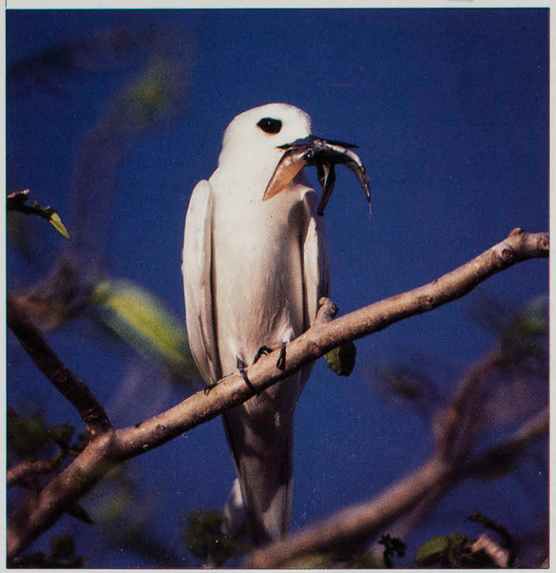
Information about Christmas Island collected from the 1940s through June 1982 reveal no total reproductive failure of any seabirds during previous El Niños; the records also provide reasonable estimates of the populations for each species, illustrate breeding seasons, and document the species' diet. The data showed that many species of seabirds breed throughout the year, but some more in one season than others. The data also confirmed that most seabird species eat fish and squid.

Shearwaters and petrels are all ground or burrow nesters and may have been flooded out by the heavy rains. In the fall of 1982 a few Phoenix Petrels *(Pterodroma alba)* and Christmas Shearwaters *(Puffinus nativitatis)* were courting, but no successful reproduction occurred. By June 1983, these birds, along with Wedge-tailed Shearwaters *(Puffinus pacificus)*, were present in small numbers, and some limited reproduction occurred. Audubon's Shearwaters *(Puffinus lherminieri)*, absent from the atoll for at least a year, and White-throated Storm Petrels *(Nesofregetta albigularis)*, absent during the winter of 1982, began to return in the fall of 1983.

Early nesting Red-tailed Tropicbirds *(Phaethon rubricauda)* were not affected in the summer of 1982, but late nesters were completely unsuccessful. Numbers of nesters were low in June 1983, but increased through the year: large numbers of healthy young were present in October 1983. Masked Boobies *(Sula dactylatra)* were nesting in June 1982 in normal numbers, with eggs or small young present in our study area. In view of the forty-five-day incubation period and the four-month nesting period of this species, large numbers of preflying nestlings and adults should have been present in November 1982; however, we found only one four-month-old nestling and three adults. The fully feathered nestling's weight (1250 grams) was about 25 percent below normal for its age. We saw few adults and no juveniles elsewhere on the atoll in November, an unusual absence. In June 1983 no eggs were present, but by October there were many adults with eggs and healthy nestlings. Brown Boobies *(Sula leucogaster)* all failed in nesting attempts in November 1982. In June 1983 some eggs had been laid, but no young hatched, and by October few adults were present. In November 1982 we found no Red-footed Booby *(Sula sula)* nests and only a couple hundred roosting birds when thousands are normally present. During May and June there were more adults, and some were nesting. No juveniles were present. In October about 20 percent of normal nests were present with eggs and healthy nestlings of various ages, and many juveniles had fledged.

Great Frigatebirds *(Fregata minor)* nested in large numbers (around eight thouand) in June 1982. In November we saw fewer than one hundred birds during our stay on the atoll. Approximately ninety nestings should have been present in our study colonies, but we found only six still alive, none of which could fly; all were starving. We also found nineteen fully feathered carcasses lying on their nests where they had died. All other nests were either empty or had been destroyed by rain. Thus reproductive success for Great Frigates was zero in 1982. We estimated that we saw thirty-five hundred pairs of Lesser Frigatebirds *(Fregata ariel)* with eggs or small young in June 1982. In November we found hundreds of dead nestlings. Perhaps three hundred young had developed flight feathers and fewer than fifty adults were present. The twelve nestlings we weighed were significantly underweight for their age. In June 1983 we estimated that approximately four thousand pairs were present, all actively courting or with eggs. In October many healthy young were present.

In November 1982 we expected to find large numbers of Sooty Terns *(Sterna fuscata)* swirling over nesting locations at night in preparation for the December–January laying season. We neither saw nor heard any sooties in late November, and none nested that season. In June 1983 about 1 percent of their normal population had returned, and eggs and small young were present. The laying period was extended beyond its usual term, and healthy fledglings were present in one colony in October 1983; however, in another colony about sixty-five kilometers away (on Cook Islet), about five thousand young starved just before fledging. Gray-backed Terns *(Sterna lunata)* were present in November 1982 in normal numbers, but no nesting occurred between then and October 1983, and few adults were present during 1983. Crested Terns *(Thalasseus bergii)* roosted in their usual numbers in November 1982, and they nested successfully from April to June 1983 and were present in October. Blue-gray Noddies *(Procelsterna cerulea)* should have been present in large numbers in November 1982, but were not, and their numbers remained low from May to June and in October 1983, when a few pairs had eggs. Brown Noddies *(Anous stolidus)* were mostly absent from the atoll in November 1982, and their numbers remained low through 1983, with limited reproduction from June to October. All nests of Black Noddies *(Anous minutus)* were washed out of trees by



An adult White Tern with fish and squid for its nestling.

Adult and juvenile Sooty Terns. Christmas Island is famous for its Sooty Tern population, which nested on a six-month breeding schedule, laying 1 to 2 million eggs in December and July. Since the 1982–83 El Niño, this schedule has become extended and fewer than 15,000 eggs have been laid each season.

A Red-tailed Tropicbird scouting for food. Red-tailed Tropicbirds nesting in late 1982 were completely unsuccessful, but large numbers of healthy young were present on Christmas Island in fall 1983.

Black Noddy Tern adults roosting on Christmas Island. The heavy El Niño rains of September through November 1982 washed all Black Noddy nests out of trees. Normal numbers of adults were present seven months later, but few nested successfully.

November 1982, and few adults were seen, but normal numbers of adults and nests were present in June 1983. In October 1983 large numbers of skeletons of young were found in nests, indicating a major reproductive failure from July to August 1983. White Terns *(Gygis alba)* were totally unsuccessful in November 1982, and few were present in June 1983. By October, however, large numbers of eggs and healthy young were present.

We believe that adult birds of all species were either flooded out of nests during the 1982–83 El Niño, or that their breeding activity and behavior were inhibited by the heavy rains and lack of food caused by oceanic changes. With the return of normal oceanic and atmospheric conditions near Christmas Island by July 1983, the few surviving individual birds of all species began to nest again. This evidence suggests that unusual atmospheric-oceanic factors serve as mechanisms for forcing evolutionary change within tropical seabird populations.

Along the west coast of South America, minor El Niños occur frequently, severe events about once per century, and major catastrophic flooding once every six hundred to eight hundred years. Seabirds are constrained in their movements to very specific, well-defined water types. The relationships between the abundance of plankton in marine waters and fish, squid, and bird stocks in some regions are documented, but virtually nothing is known about the marine food chain of the equatorial central Pacific Ocean. However, a break in the food chain there is likely to have more subtle and complex ramifications than along coasts, as these warmer tropical waters regularly produce less on which the seabirds can feed than do cool coastal waters.

The El Niño that lasted from August 1982 through at least April 1983 in the vicinity of Christmas Island caused major changes in marine populations in the area. Depleted stocks and low growth and survival rates of adult and larval fishes and squid during this period resulted in a decrease in the birds' food supply. Decreased reproductive success and the deaths of adult birds ensued.

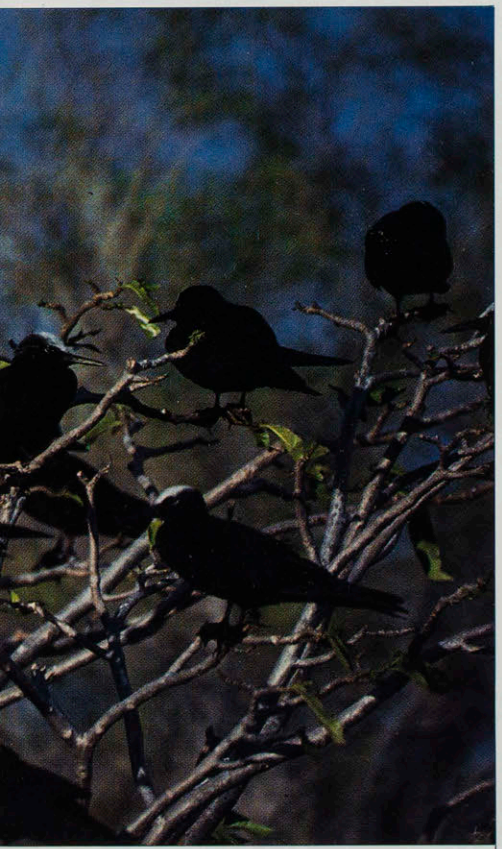
In the eastern Pacific, the increases in abundance of phytoplankton (that is, plankton consisting of plant life) after an El Niño shows the potential for a coastal upwelling system to support rapid recovery of the fish populations. But whether the equatorial open sea system with its inherently lower biological productivity and thus more stable interactions can recover rapidly enough to support the seabird population has not been shown. The opportunity now exists to compare the central Pacific low-nutrient system with the nutrient-rich system of the eastern Pacific, and we can examine the recovery of the entire ecosystem by monitoring the return and reestablishment of the seabird breeding populations on Christmas Island.

Our study concerns seabirds that live on one oceanic island. Other studies have shown that irregular anomalies in global atmospheric circulation patterns, such as the severe 1982–83 El Niño, affect birds around the world, some far from marine ecosystems.

The responses of seabirds to the 1982–83 El Niño in the oceans away from the Central Pacific were also dramatic and have been reported for the Hawaiian Islands, the Galapagos Islands, Ecuador, Peru, Chile, Panama, the entire west coast of North America to the Gulf of Alaska, the Caribbean, Great Britain, and South Africa. Birds in many of these places did not experience a total reproductive failure such as occurred on Christmas Island in fall 1982 and spring 1983 but instead exhibited subtle changes such as reduced number of breeding pairs and slower growth rates of nestlings. This is really the first time that the worldwide ramifications of El Niño on birds have been realized, and it is proving to be a fascinating study.

Seabirds are an important indicator of events in the upper layers of the ocean and their study should be included in more oceanographic research. As seabird ornithologists we need to understand oceanic-atmospheric interactions, especially primary productivity and fish-squid abundance. Such information is critical to explaining seabird biology. We plan to continue our studies until we have a more complete picture of how seabirds make their living in the vast waters of the Central Pacific Ocean.

Dr. Ralph W. Schreiber is Curator and Section Head for Birds and Mammals, and Elizabeth Anne Schreiber is a Research Associate of the Natural History Museum of Los Angeles County. *They have been studying tropical seabirds together for thirteen years. The research on which this article is based was supported by the National Geographic Society, the National Science Foundation, and Mr. T. L. Cross, whom the Schreibers wish to thank. A version of this article appeared in the 17 August 1984 (Vol. 225) issue of* Science *as "Central Pacific Seabirds and the El Niño Southern Oscillation: 1982 to 1983 Perspectives."*



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Adult Masked Booby stands its ground. In November 1982 the authors found only one nestling and three adults on Christmas Island. The nestling's weight was 25 percent less than what it should have been, and hundreds of adults and nests should have been present.

A dark-phase downy chick of the Brown Noddy. This ground nesting species was especially hard hit by the heavy rains and high sea level of El Niño.

Two-month-old nestling Great Frigatebird. In November 1982 the authors saw fewer than one hundred birds when there should have been thousands, and only six nestlings—all starving—rather than the hundreds they expected.

Opposite page, bottom: By May 1983 on Christmas Island only skeletons of nestling Great Frigatebirds remained from the annual nesting attempt.

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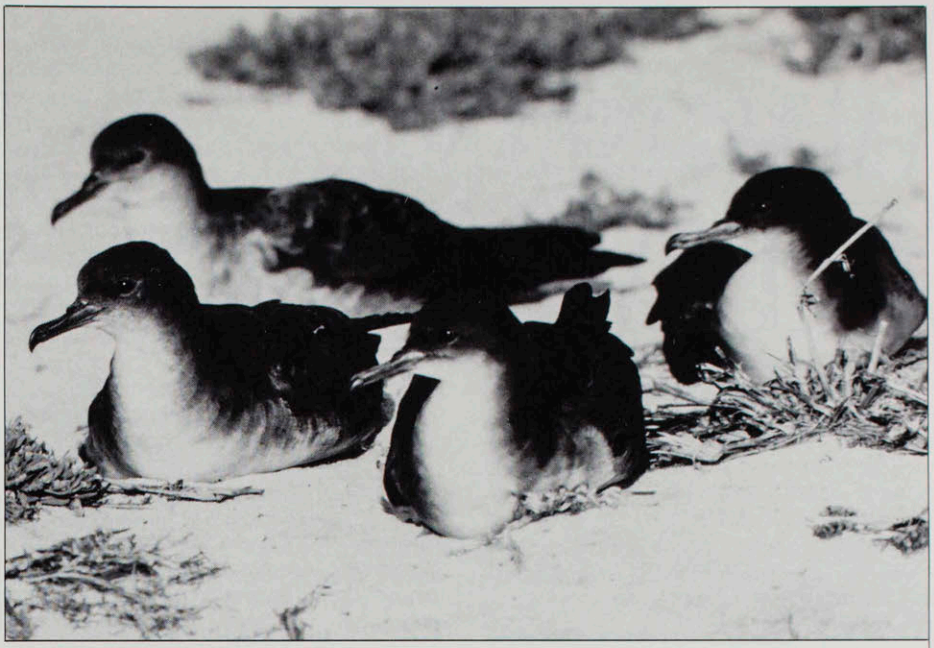

Adult Wedge-tailed Shearwaters congregate on the ground around their nesting burrows prior to beginning incubation.

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AMAZONIAN INSECT MYTHS

by CHARLES L. HOGUE

Photographs by the Author

The influence of insects on human culture has been much greater than most people generally acknowledge. What follows is only a regional sample of a vast global folklore that has persisted from our earliest history and that continually evolves in response to a basic human need for symbolic expression and simple explanations of natural phenomena. The ethnological and popular literature abound with examples of the Amazonian people's propensity for incorporating insects into their mythology. But this was a practice of all our ancestors; mythmaking is a universal tendency of *Homo sapiens*, and we should realize that we have inherited many ideas born in our primitive past from encounters with the insect world.

If there are as many insects in the scrubby seasonal tropical forests of Panama as estimated by Smithsonian coleopterist (a beetle specialist) Dr. Terry Erwin, who calculates well over forty thousand species per hectare (2.5 acres), the vastly more extensive and botanically complex Amazonian forests should contain many times this number. Using his formula based on an assessment of 163 canopy-dwelling beetle species per tree species, adjusting for other kinds of forests and insects, and assuming twenty thousand Amazonian tree species (40 percent of the world's fifty thousand tropical trees), the Amazon Basin could contain a population of twelve million insect species!

Science is dealing with this vast assemblage in a plodding, methodical way, searching out facts and building explanations of insect form and function based on evolutionary theory. The people who live with these insects, but who know nothing of the formalities of the scientific method, take them as familiar elements of their environment and derive commonsense explanations for their presence and natural history. This reasoning process is often driven by superstition, and interpretations of insect biology are commonly framed in utilitarian, healing, or anthropomorphic terms.

The Rio Cayeru, a typical black water tributary of the Amazon, near Leticia, Colombia.

The result is myth more often than reality.

A great mythmaking people have been the Amerind aboriginals, many of whom still populate Amazonia and preserve in tradition myriad animistic cultural beliefs and practices, including many based on insects. For example, Dr. Johannes Wilbert, a UCLA anthropologist, tells us that the astronomical orientations of the cosmology of the Warao Indians, who occupy the Orinoco delta region of Venezuela, are based on the lives of four major social insect types: arboreal termites, two kinds of stingless bees, and a paper wasp. Additionally, the owl butterfly *(Caligo)* is a god of the northern portion of the tribe's universe.

In myth, the mighty Amazon River itself, shaper of the land and sustainer of life over this vast region, owes its origin to the involvements of a variety of insects. According to the Yagua Indians of the upper Amazon, the "tree of water" —which yields life's most important necessity, water for the fields—was discovered and sinfully used by the two grandchildren of the old man entrusted by God to guard the tree. First they took the water from vats that their grandfather filled for use by the people. To discover the source of the water, the little girl changed herself into a hummingbird and spied on the old man, whom she watched slash the tree with his machete to release the flow. The children decided to cut down the tree so that their own plants would never lack water. Because they had no tools, they sought the help of all the jungle creatures that could gnaw, peck, and chew wood to devote themselves to this task, including vast armies of leaf-cutting ants *(Atta)* and termites. But the tree healed its wounds every time they tried. Then the boy changed himself into an ant and rode on his grandfather's shoulder to find out how the tree could be vanquished. The old man, thinking himself alone, muttered, "Let them go on cutting with all of their jungle friends.... The tree will never fall unless some poisonous insect bites me on my big toe!" The next day the boy changed himself into a scorpion and stung the man on his big toe. At that instant, the great tree fell and the trunk became buried in the ground and changed into a torrent of water that began to flow to the east. The Amazon was born!

Not only the Indians but the early European settlers of the Amazon Basin,

mostly unsophisticated farmers, miners, and privateers, also exercised their imaginations, contributing to Amazon insect lore. And the process has not stopped with modernization; curious ideas are still being generated and modified by untrained observers among the general population and especially among tourist guides and the tourists and travelers themselves. Even supposed trained biologists have unwittingly added to the store of entomological fiction in South America.

Unquestionably, the insect most decorated with fantastic attributes in Amazonia is *Fulgora laternaria*, the so-called Lantern Bug. This common name, based on the bug's supposed ability to produce light (captured in the scientific name *laternaria*, meaning lantern), appears to have originated in confused observations recorded by Madam Maria Sibylla Merian, a Dutch naturalist who spent over two years in Surinam at the beginning of the eighteenth century. In one section of her monumental work *Metamorphosis Insectorum Surinamensium* (1705), she discusses the Lantern Bug, including notes on the Cucujo (a large, luminous click beetle) and cicadas. Believing the natives' credulous anecdotes, she even thought Lantern Bugs metamorphosed from cicadas. "One finds these 'flies' [cicadas] very commonly in Surinam ....They make a noise like a lyre sings ....The Indians assured me that out of these 'flies' emerged the so-called 'lantern dragons.'" She goes on to describe the alleged fluorescence of the *Fulgora's* head. "The males and females, while sitting or flying, show the same heads or 'caps' [the head protuberances of the two insects], which at night are lit like a lantern, while being transparent as a bubble by day." Finally, she relates a personal experience that would seem to establish the fact that the insects are capable of producing light:

> The Indians brought me at a certain time a great many of these lantern dragons—before I knew that they gave off such a glow at night—which I put into a large wooden box. At night they made such a noise that we awoke with fright and jumped out of bed to light a candle, not knowing what had happened in the house. Quickly we became aware that it had been in the box, which we opened with astonishment. Then ...in the opening of the box...four of them came forth in "flames." So many beasts, so many came out enflamed! After we calmed down, we caught them again and were very amazed by the glow of these little beasts.

It is virtually certain that this passage describes the Cucujo; the so-called Lantern Bug has never since been observed to produce light in any manner.

The Lantern Bug is also known in Tupi-Guaraní (the lingua franca of Amazonia) as *jaquitiranaboia*, and many Brazilian Indians will call it this or some phonetic equivalent. The name refers to something reptilian—a snake or lizard is implied. Because of its serpentlike appearance and formidable, quarter-inch rigid beak, it is considered venomous and deadly by practically everyone who has ever heard of it. In reality it is harmless, feeding on the sap of several species of resinous trees by piercing the bark with its hypodermic mouthparts. In Leticia, Colombia, I was once photographing a live specimen in full view of an elderly local resident who beseeched me to be very careful on account of the dangerous nature of my subject. I could not resist some dramatics and pressed the insect to my face and skin to prove its harmlessness, at the same time assuring the lady that I was a *biólogo* and knew what I was doing. But it was too much for her and she writhed in disbelieving horror during the whole episode.

The allegedly deadly bite of the Lantern Bug, or the *machaca*, as it is called in Spanish-speaking areas, has a folk antidote. It is a widely circulated story that persons who have the misfortune of being bitten by this bug will die if they do not have sexual relations within twenty-four hours. The origin of this bit of jungle lore is obscure, but it is likely that it was an invention of the randy *caucheiros* (latex gatherers) of nearly a century ago.

Some consider the insect as nonvenomous but capable of injecting an aphrodisiac. This seems to be an extention or misunderstanding of the more widely held "sex-antidote" belief. The belles of San Cristobal, Venezuela, according to a local newspaper, believe in the abilities of the bug to produce feelings of *amour*. Carmen Cecilia, who was interviewed, said, "The machaca has aroused us: I would like to be bitten to enjoy its effects. I don't care what the prudes think!"

Why the human race, with a world population of over four billion, goes on looking for aphrodisiacs I can never understand, but the quest presses well beyond rhinoceros horns and oysters, as these stories evidence. Even the horns of the large rhinoceros scarab beetles are ground and consumed in Central America for this purpose. (Of course, the alleged erotic effects of the Spanish Fly—actually a blister beetle—are well known.)

The Lantern Bug is also said to sing, emit foul odors when disturbed, and mimic an alligator. These other talents are also yet to be proven.

Mythology everywhere is rich in transformations—the simplest way out of a dilemma or to practice deception is to change form. People become animals, animals become people, inanimate objects acquire souls, gods live on earth as humans. These are common themes even in classical mythology. Remember Artemis who changed into a stag to spy on her lover and changed back into human form to escape from hunters? Changes between the plant and animal kingdom, however, are rare, probably because of the disparity in form and physiology between these kinds of organisms. But similarities do occur. Indians will tell you that leaves will turn into praying mantids or katydids: "How can you deny it when they are so alike in every detail!" Thus is the phenomenon of mimicry explained simply.

Another Amazonian jungle mystery is similarly solved. Fungi of the genus *Cordyceps* commonly attack insects, eventually killing them and sprouting wiry fruiting bodies from the hosts' corpses. The giant forest hunting ant, *Dinoponera grandis*, is susceptible to the fungus. It is frequently found along forest trails, dead, but still gripping its perch in the throes of rigor mortis, and sprouting the characteristic pink-tipped sporangia of the fungus. The natives take the latter

(Continued on page 14)

EXHIBIT: INSECTS OF THE AMAZON BASIN

An exhibit of Dr. Hogue's photographs of the Insects of the Amazon Basin will be on display in the Director's Gallery through this summer. Also included are photographs by Jeanne Bellemin and Mark Hoffman of Santa Monica, George Dodge of Duarte, and Larry D. Munsey of Anaheim. The latter are past participants in the UCLA Extension field study course co-instructed by Dr. Hogue. The examples chosen for the display are representative of the fabulous structure, amazing beauty, and variety of life styles of insects everywhere in the Amazon.

Lantern bugs and cicadas, from Madam Merian's Metamorphosis Insectorum Surinamensium *(1705). Note the hybrid cicada/lantern bug on the flower at the bottom. Madam Merian never saw such a creature, but believed the Indians' story that they existed and that one metamorphosed from the other.*

The so-called Lantern Bug (Fulgora laternaria). *Many people in the Amazon basin still believe that the large head protuberance glows in the dark, in spite of the lack of scientific evidence for bioluminescence in the species.*

The Lesser Giant Hunting Ant (Paraponera clavata). *The sting of this species is much more debilitating and powerful than that of its relative* Dinoponera. *It is probably not the ant used in Amazonian Indian puberty rites.*

A Greater Giant Hunting Ant (Dinoponera) *killed by a parasitic fungus* (Cordyceps). *The sporangia are sprouting from the ant's body and are thought by Amazonians to represent incipient jungle vines of the type* (Carludovica) *used for binding poles. Both ant and vine are called* tamshi.

A natural clearing in the forest (near Iquitos, Peru), considered by the locals as the chacra *(farm) of the* chulla chaqui, *a malicious, furtive gnome. Ant symbionts of the* Duroia *shrubs that border such clearings are probably responsible for keeping these areas clear of seedlings.*

Marching harvester termites, species unknown. Such organized behavior, resembling human activity, provides symbolic models for the cultural life of many Amazonian Indian groups.

(Continued from page 11)

for developing lianas, especially the type they commonly use as binding thongs for their houses *(cipo-titica* or *huambe; Carludovica divergens).* Both the ant and the vine are commonly called *tamshi.*

Dinoponera grandis is a very large ant, some say the largest in the world, with a body an inch and a quarter long. It is also considered very dangerous in Amazonia, where it carries the ominous appellation *veinte-y-cuatro,* referring to the twenty-four hours you have left to live if you are stung by it. Actually, there is probably a confusion with a related species, *Paraponera clavata,* which is also very large but slightly smaller than *Dinoponera.* The sting of *Paraponera* is horrific, extremely painful, long lasting, and known in rare cases to cause fever, respiratory arrest, and even death. But, according to Dr. Murray Blum, an insect venomologist who studied the species in the Amazon a few years ago, *Dinoponera* is in reality a "pussycat." "I let specimens run up and down on my bare arm and they never showed any tendency to sting."

The difference in the toxicity of the two ants may be behind the ability of initiates participating in a tribal puberty rite to survive the ordeal of being stung repeatedly by large black ants. Several dozen ants are tied to a wicker framework so that their sting-bearing abdomens protrude from one side. The maddened mass is pressed onto the bare skin of the subject and induced to sting. The youth is expected to endure the pain without complaint and, all hope, to survive the illness that usually follows. It is hard to imagine how anyone could withstand multiple stings of *Paraponera* and not become violently ill; but perhaps it is the milder *Dinoponera* that is used with painful but survivable results.

Yet another quaint tale of transformation involves the large and brilliantly metallic blue Morpho Butterfly that adorns the Amazon forest. This is the story as I heard it from guides at Yanamono, about sixty kilometers downriver from Iquitos, in Peru, while we talked in a small natural jungle clearing.

Kobeua Indians dressed in Morpho Butterfly costumes for a mask ceremony (about 1905). The bowls contain water thought to be used by the butterfly to spread malaria.

This kind of clearing is found throughout the great forest. In it grow no trees, only a ground cover of club mosses, ferns, and a shrub *(Duroia)* that produces an orange fruit and harbors ants (which are probably responsible for keeping the area clear of other vegetation). These clearings are the *chacras* or farms of the *chulla chaqui,* a furtive gnome who lives near the clearings and eats the fruit of the shrub. The chulla chaqui is described as a short man with an artificial leg and a devilish personality. He is also a changeling who assumes animal shapes to elude discovery when perpetrating mischief. One of his favorite forms is that of the blue Morpho Butterfly, and as such he can easily attract the attention and curiosity of wanderers and lead them into the forest. He then disappears—as does the Morpho, which immediately blends into the background when it folds its wings because the undersides are cryptically colored—and leaves the hapless person lost. The chulla chaqui reportedly finds this a jolly pastime!

Perhaps because of this legend, the Yurupary-Cachoeira, studied by Theodor Koch-Grünberg in northwest Brazil in the early 1900s, considered the Morpho a most dangerous demon, and it was depicted in mask ceremonies with a calabash from which, it was believed, malaria was spread. The role of the *Anopheles* mosquito in malaria transmission was unknown to these people during Koch-Grünberg's time.

It is ironic that the real metamorphoses of insects are as extreme and amazing as the mythological, but little known by the uneducated human forest inhabitants.

Streams of green light in the dark. What a wonderful substance from which to concoct myths. Luminescent insects have also inspired a surfeit of legends and superstitions.

"Headlight beetles" or Cucujos (mentioned earlier in connection with Madam Merian's observations) are large click beetles (Elateridae, *Pyrophorus*) notable for their unique ability within the family to produce light. An intense, continuous flash emanates from two round light organs on the front of the insect's thorax and from a second broad area on the underside of the first abdominal segment. The illumination is so intense that people in the past too poor to own candles made reading lamps of perforated gourds with these insects inside. Peter Martyr, in his *History of the West Indies* (1612) notes that "the islanders ...go with their good will by night with 2 cucuji tyed to the great toes of their feete."

This is fact. Martyr also promoted the fiction that these beetles catch mosquitoes and are useful in keeping houses free of pests. He wrote of the belief of local people that if they attracted the beetles by burning coals (which the insects mistake for the courtship signal of a potential mate) and released them indoors, the beetles would eat other, less desirable insects. In reality, the adults are plant feeders and never prey on other insects.

Firefly flashes are intermittent and not so luxuriant as the Cucujo's. As points of light in the black night they have tempted the forest mythmakers to describe their light as derived from stars and take them as gifts from the gods to provide hope and guidance to the human race through the dark passages of life. The Aztecs believed that gods could speak to men, and communication be-

tween heaven and earth took place through the medium of song and flowers. "A firefly in the night" was how they described song, that is, "a small point of illumination in the darkness of earth."

By contrast, the Andeans, a people considered to have a more melancholy view of life, regard these little beetles (Lampyridae) with suspicion and call them *añañahui* ("ghost eyes" in the Quechua language).

A connection with eyes also seems to be behind the general idea in all of Brazil that catching a firefly in the fingers and later carelessly rubbing the eyes with the same fingers provokes blindness. For this and other reasons there is a general dread of these insects in the region; if one falls into the food, a cook, thinking it venomous, will immediately throw the whole lot out. Lately, Thomas Eisner and his biochemist associates have found poisons in the blood of fireflies similar to those found in toads. The substances impart a foul taste to the insect and, no doubt, to the food.

On the other hand, certain *curandeiros* (witch doctors) in the same country affirm that fireflies are useful in *curing* blindness! This is done by rubbing the insects into the eyes of the blind person, but only by the curandeiros themselves, of course, because only they know the proper incantations that must accompany the treatment.

Termites are conspicuous because of their numbers, especially when swarming through the air as winged sexual forms on their mating-dispersal flights or during the terrestrial migrations or foraging marches of the workers and soldiers guarding them. Many also build large nests in trees or rising from the earth, and their destructive habit of eating wooden houses is common knowledge. The group best known for making arboreal nests are the *Nasutitermes*, or snouted termites, so named for the elongate beak on the worker's head, from which it emits stringy, smelly threads used to entangle and repel enemies. Termite social organization also creates a basis for human comparisons, and this has given these insects an especially important role in the mythological world.

Each of these elements of termite biology has inspired different categories of superstition and folklore, many of which are recorded by Karol Lenko and Nelson Papavero in their book *Insetos no Folklor.* In Brazil, the ability of snouted termites to squirt a substance from their beaks would seem to be the basis for the way the *coboclos* (peasants) change rainy weather. They only have to throw a piece of termite nest on the ground: "The insects clinging to the piece begin to cry and appeal to God to stop the rain and make the sun shine again."

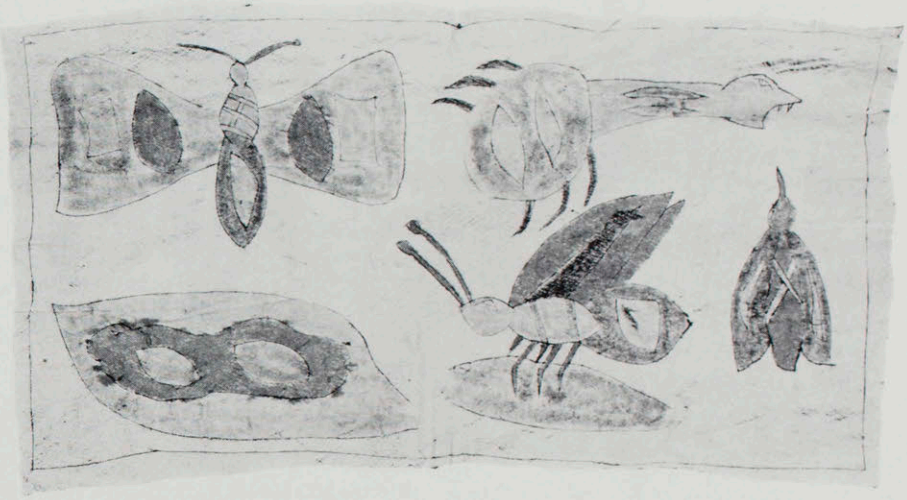
The wood-boring activities of termites in houses probably is behind the Brazilian superstition that the insect is a harbinger of death. According to another of Lenko and Papavero's sources,

> Termites have the occasional habit of producing with their abdomens a series of ten or more tapping sounds on the sides of their tunnels inside furniture or walls in which they are located. This tapping is ominous and clearly audible, especially in the silence of night. This has given rise to the belief that with these taps, the termites are presaging the imminent death of an inhabitant of the house.

(This is a warning like that of the Death Watch Beetle of Europe.)

Termites *(rorot)* are held in contempt by the Gorotire Kayapó Indians of the Amazon area, according to the investigations of Dr. Darrell Posey, who has spent considerable time in their midst, studying their ethnoentomological characteristics. Termites are considered "in alliance with worthless people" and themselves worthless. They are weak and cowardly and, although they appear to live social lives as do people, they are neither brave nor strong like other insects. They are subgrouped according to where they nest and by color to correspond with the colors of the human races. *Rorot-tykre* build nests in trees and are the "black" termites associated with the origins of black people on earth; *rorot-kra-kamrek-ti* nest in the wood of houses and are associated with the genesis of other Indians or red people; the pale *rorot-jakare* live in the ground and are connected with white Europeans; and the *rorotire* build large, grayish mounds, the portal for entry from which all non-Kayapó came originally from the underworld to populate the earth.

By contrast, to the same tribe, ants *(mrum)* are a source of great interest; their social nature is thought to be like that of the Kayapó and so important that numerous subtypes are recognized. They are spoken of in terms of their "power" or ability to inflict pain. Posey relates that stinging ants are often collected by the men, pounded into a paste with red urucu *(Bixa orellana* or lipstick plant), and painted on their hunting dogs. This is supposed to cause the dogs to keep their noses to the ground and hunt with determination as do the ants.

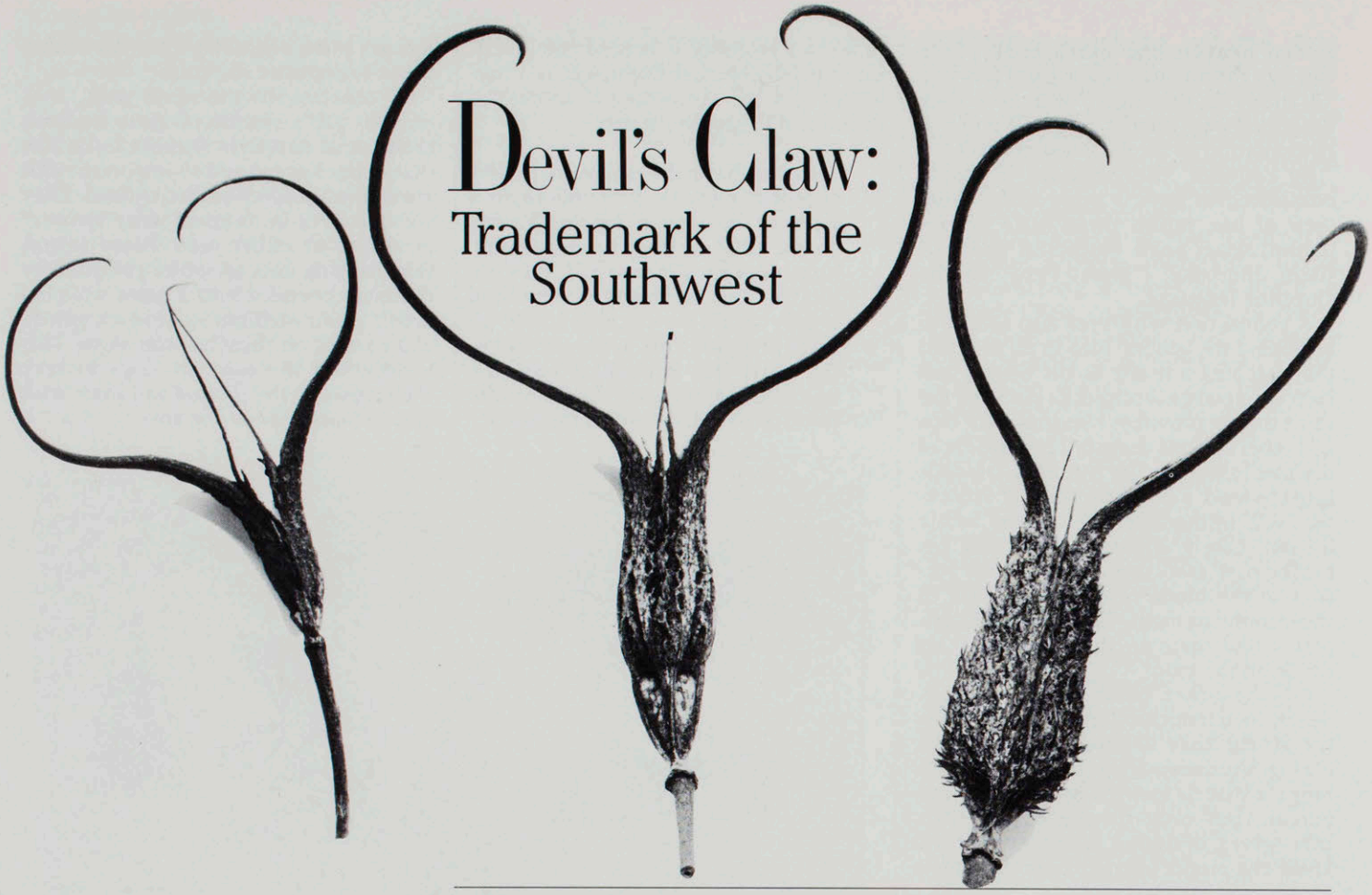


Ticuna barkcloth with vivid paintings of insects. This modern example of an ancient artistic tradition reveals the people's continued interest in local (Leticia, Colombia) Amazonian insects.

Today, unfortunately, much of the Amazon Basin's culture is disappearing as a result of acculturation of the aboriginal populace and the penetration of the mass media to even the remotest parts. But the great forest will take a while to conquer, and for a time at least we can expect insects to continue to have a strong influence on the lives of the people there. Bugs will go on biting, wasps stinging, mosquitoes transmitting disease, giant beetles impressing with their bizarre forms and butterflies with beauteous colors, and new tales will be invented to join the old in the growing compendium of Amazonian insect mythology.

Dr. Charles L. Hogue is Curator of Entomology at the Natural History Museum. His interest in cultural entomology is nourished by yearly visits to the Peruvian forests as co-instructor for the UCLA Extension class, Tropical Ecology: The Amazon. Many of these tales are being woven into a book he is now writing on Latin American insects and entomology.

Devil's Claw: Trademark of the Southwest



Dried devil's claw seedpods: Left, Proboscidea altheifolia. *Center,* P. louisianica. *Right,* Ibicella lutea *(note the prickly spines on the body of the capsule).*

by Wayne P. Armstrong

Photographs by the Author

There are hundreds of beautiful wildflowers in the southwestern United States, from spectacular penstemons, poppies, and Indian paintbrush to striking desert five-spot and magnificent mariposa lilies. But one of the loveliest and most interesting wildflowers is the devil's claw, which produces a most unusual seedpod. The rather sinister common name refers to the woody seedpod or capsule, which splits open at one end into two curved horns or claws (also sometimes called "elephant tusks"). The pod contains about fifty black seeds that are gradually released as the claws split apart. The plant is also known as the "unicorn plant," referring to the appearance of the large, hornlike pod before it has split open. The pods readily cling to the feet of grazing animals or your shoes if you happen to step on them, and in some areas of the southwest they are a nuisance to sheep ranchers because they can become entangled in sheep's fleece.

There are actually two species of devil's claw native to the southwestern United States, an attractive pink-flowered annual *(Proboscidea parviflora)* and a brilliant yellow-flowered perennial *(P. altheifolia)*. During the hot summer months both species form sprawling, pumpkinlike plants with clammy, sticky foliage long after most other wildflowers have bloomed and gone to seed. One plant may produce fifty to one hundred of the curious pods, which ripen by late summer and early fall.

All devil's claw plants belong to the Martynia family (Martyniaceae), a small family found mostly in warm subtropical and desert regions of North America. The Martynia family is closely related to the Bignonia family (Bignoniaceae), and the blossoms of devil's claw plants are strikingly similar in general appearance to those of *Catalpa, Jacaranda,* and *Bignonia.* Several species of bee frequent the fragrant blossoms, which often have bright yellow guidelines and reddish-purple flecks along the inner corolla tube.

Several additional species of devil's claw in three different genera are naturalized or cultivated in the southwest. *P. louisianica* has large pinkish-white flowers and is native to the southeastern United States. It is sometimes grown in gardens, but many gardeners consider the strongly scented foliage unpleasant and overpowering. *P. fragrans,* a similar species from Texas and northeastern Mexico with beautiful violet to reddish-purple flowers, is also grown in gardens. A robust, yellow-flowered species, *Ibicella lutea,* is occasionally naturalized in California's Central Valley. It is native to and cultivated for food from Brazil to Argentina. The dried seedpods of this species are unique among devil's claw plants because the body is covered with short, prickly spines, thus making it a doubly effective hitchhiker. The generic name *Ibicella* is appropriately derived from ibex, a Himalayan mountain goat with magnificent curved horns.

Another pink-flowered devil's claw with unusually small seedpods, *Martynia annua,* is native to Mexico and tropical America and is naturalized in several parts of the world. The sun-bleached seedpod, with its short, fanglike claws, superficially resembles the upper jaw and skull of a pit viper. In Mexican novelty shops I have seen an artificial sunflower with outer petals made from a ring of the small pods of *M. annua* hooked around a central disk.

When the devil's claw seedpods hang in clusters on the plant's branches, the green fleshy fruits look much like

NEWSLETTER JULY/AUGUST 1985

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY, EXPOSITION PARK
PAGE MUSEUM OF LA BREA DISCOVERIES, HANCOCK PARK

SPECIAL EVENTS

Maya: Treasures of an Ancient Civilization

The most spectacular exhibition of Maya art ever assembled will be opening at the Natural History Museum of Los Angeles County on September 7, 1985. This is the first comprehensive survey of the remarkable artistic heritage of the Maya, who created masterpieces of astonishing aesthetic refinement and technical brilliance; many of the priceless art objects have never before been seen outside of their native countries.

Museum members will receive two free tickets to the exhibit and can begin reserving viewing times on July 1. (Tickets will not go on sale to the public until August 1.) You may remit your ticket order form, which was mailed to you in June, to any Ticketmaster outlet (including all May Company and Music Plus stores) or the museum's Membership Office. You may purchase additional tickets at this time.

Ticket prices are: adults, $4; children (5 to 12) and senior citizens (62 or older), $.75; groups (arranged through the museum), $3 weekdays, $3.50 Saturdays. Your ticket is also good for $1 off admission to the California Museum of Science and Industry's Imax Theater. You may charge tickets by phone from Ticketmaster at 213/480-3232, 714/740-2000, 619/232-0800, or 805/583-8700. There is a ticket handling charge.

The special exhibit hours for Maya: Treasures of an Ancient Civilization are Tuesday through Thursday 10 a.m. to 5 p.m., Friday 10 a.m. to 8 p.m., and Saturday and Sunday, 10 a.m. to 6 p.m.

For further ticket information, please call the Membership Office at 213/744-3426.

Maya: Treasures of an Ancient Civilization will be running through November 10, 1985.

MEMBERS' TRAVEL PROGRAM

Travel Fair

Join us for some vicarious travel thrills, or perhaps a preview of your own adventures, at our first Travel Fair on Thursday, July 11, at 7 p.m.

We will have a special slide show and presentation on India and Nepal by Dr. Siddiq Wahid. Also of special interest to our members will be a slide presentation on the Galapagos Islands and Halley's Comet tours.

There will be people to talk with and information available on each of the museum's upcoming travel programs. Whether you are thinking of joining us on a trip or have already signed up to go, the Travel Fair will be an enjoyable and informative evening. And feel free to bring friends along!

Please RSVP (213/744-3426), as attendance is limited.

GRAND CANYON RIVER RAFTING, September 1–7, 1985 John Wright, our popular Curator of Herpetology, will lead this exciting trip on the Colorado River. Floating through the ageless Grand Canyon is an unforgettable experience, and many of those who went on this trip last year plan to join us again. The trip includes lectures on geology, archaeology, wildlife, and other fascinating aspects of the Grand Canyon. $525, including round trip train fare.

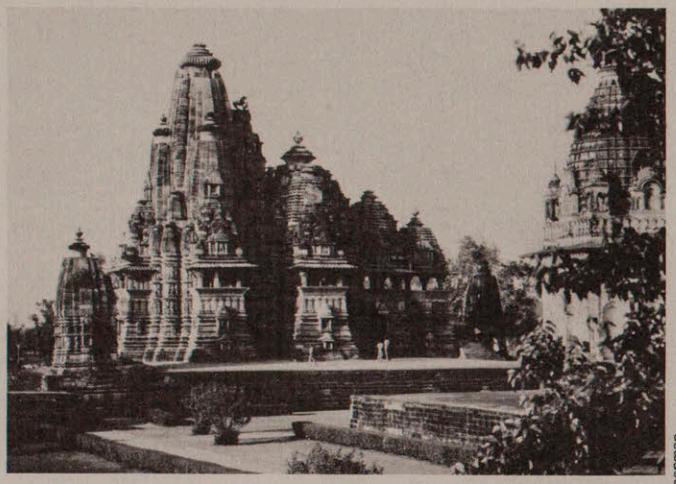
CHINA & YANGTZE RIVER ADVENTURE, September 13–29, 1985 *China is the most popular destination so far this year for our members. We have filled two tours and are starting a third! This new trip (9/12–10/2) will cost about $400 more and will include a trip to Xian (total 21 days).* Come join us for a truly exotic adventure through China! Our cruise down the Yangtze, the world's third-largest river, will take us where few Western travelers have sailed—through the three Yangtze Gorges with a wild beauty so spectacular that it is impossible to exaggerate their splendor. We will visit Beijing's Forbidden City, the gardens and pavilions of the Summer Palace, and the Ming tombs. Visit an agricultural commune, silk factory, oriental rug factory, museums, the Beijing Zoo, and the World War II capital Chongqing. We'll go shopping in Hong Kong, feast on Peking duck, and walk along the Great Wall. This trip is during the cooler fall weather when traveling in China is most comfortable. From $3,899, including air fare.

MONTEREY SEA AQUARIUM, November 1985 Call 213/744-3426 for more information.

EGYPT & THE NILE, October 10–25, 1985 Who hasn't dreamed of traveling back in time to explore the mysteries of ancient civilizations? And what more fascinating destination than Egypt for such a trip? Museum members will make some of those dreams come true as they travel back nearly five thousand years with expert Egyptologist and accomplished archaeologist Dr. Nabil Swelim. We will visit the remarkable step pyramid of Pharaoh Zoser, the mysterious Sphinx, and the temple remains of Karnak and Luxor. Experience the exotic Khan el-Khalili Bazaar, bustling Cairo, and the charms of Aswan. To complete the dream, the trip will include an eight-day cruise down the Nile. From $3,491, including air fare.

NEW ENGLAND FALL FOLIAGE, October 16–26, 1985 Commencing our journey in Boston, we will view the colorful fall foliage of Massachusetts, travel along the seacoast, and through Maine's Acadia National Park, the White Mountains of New Hampshire, the Green Mountains of Vermont, and Lake Placid and the Adirondacks in New York. In addition to the beautiful golds and russets of the woods, we'll explore New England's historical sites and small villages. $1,595 including air fare.

INDIA & NEPAL, Temples & Tigers, November 8–24, 1985 Starting in Nepal, the fabled jewel of the Himalayas, visit Katmandu, set against the backdrop of snow glistening on the highest mountains in the world. Elephants will transport us on a safari through Chitwan National Park, where we will look for tigers and leopards from special blinds and stay in the famous Tiger Tops Jungle Lodge. In India we will float down the Ganges to see the Hindu faithful worshipping at the Ghats, view the Taj Mahal by moonlight, see the beautiful Amber Palace, and many exotic temples. We will view



Becky Chapman

Top: Some of the best Hindu sculpture can be seen on the temple walls at Khajuraho in north-central India. Of the eighty-five temples built here between A.D. 950 and 1050, twenty remain.

Bottom: A sunrise boatride gives an excellent view of Varanasi, India—perhaps the world's oldest living city—on the banks of the sacred Ganges.

rare wildlife at Bandavgarh National Park and the Bharatpur Bird Sanctuary. We will be escorted by an expert on the cultural history and ecological heritage of this varied and exotic subcontinent. (Dr. Siddiq Wahid, formerly of Harvard University, will give a presentation at our Travel Fair on July 11th.) Optional trip available to Nagerhole National Park/Kabini River Lodge in southern India. $4,331, all inclusive.

GREECE, November 4–17, 1985 Our trip to Greece will focus on the natural history of this beautiful and ancient country. We will see the sights of ancient Athens: the 2300-year-old Parthenon, the royal palace, Hadrian's Arch, and Temple of Olympian Zeus. Mystras, a dead Byzantine city, is the equivalent of Pompeii in its completeness—a vast museum of architecture, sculpture, and decorative art. By boat we'll tour the Diros Caves, some of the world's most beautiful underwater caves. At Olympia we will see the stadium where the first Olympic Games were held in 776 B.C. Drives through the countryside and short walks through mountain forests will allow us to see parts of Greece most tourists miss. From $1,759, including air fare.

TRANSCANAL CRUISE, December 2–14, 1985 Travel on the luxurious *Fairsea* to the sleepy fishing village of Cabo San Lucas and on to Mexico's resort jewel Acapulco. One day will be spent cruising through the spectacular Panama Canal. Entering the Caribbean, our first island call will be the San Blas Islands. We'll shop for emeralds in historic Cartagena, Colombia, and explore the sights of the walled city of the Spanish Main. The Dutch islands of Curaçao await us next; the gingerbread architecture and wonderful shops of quaint Willemsted will enchant you. A visit to Aruba concludes this twelve-day odyssey. $2,695, including air fare.

COSTA RICA, December 16–28, 1985 Costa Rica, with its exotic flora and fauna, its colorful people and culture, and its wild and beautiful parks, is one destination you won't want to miss. A country smaller than West Virginia, Costa Rica has more species of birds and mammals than the continental United States and Canada combined. This tiny jewel of a country has an internationally renowned park system, world-class river rapids, and unmatched plant life, including over one thousand species of wild orchids alone. Join us on a trip specially designed with our members in mind as we explore the wonders and wilds of Costa Rica. This tour includes an exciting introduction to whitewater river rafting. $2,475, including air fare.

THE GALAPAGOS AND ECUADOR, January 5–21, 1986 From $2,779, including air fare. Call 213/744-3426 for more information.

ANTARCTICA, January 1986 Cruise with leading scientists, including Bob Brownell, Research Associate with the Natural History Museum and Chief/Marine Mammals Division for the U.S. Fish & Wildlife Service, and explore the seas and land of this southernmost continent. Our trip will emphasize the cetaceans—the great whales of these frigid seas; seabirds, including the ubiquitous penguins; and geology of this remote land. See the next issue of TERRA for more information.

HALLEY'S COMET CRUISE, March 29–April 12, 1986. Call 213/744-3426 for more information.

Local trips are offered to museum members through California Natural History Tours. Most trips are accompanied by a natural history expert from the museum. Call 213/744-3426 for more information about these or any other Members' trip.

EARTH AND SKY, August 10–11, 1985 A geologist will lead us through earthquake country and the Tehachapis, followed by a program under the stars as meteors streak across the sky. $175, includes food for two full days, tent, and transportation.

SANTA CRUZ ISLAND, RANCH HOUSE, August 16–19, 1985 Stay with us in a rustic ranch house, which has its own private mile-long beach just a short distance away. Archaeological sites, forests, and beaches will be visited. $495, including all meals, lodging, and boat and jeep transportation.

CONDOR WATCH, August 24, 1985 This is your chance to tour one of the areas where you have the greatest chance to see the majestic and rare condor. Dr. Ken Stager, Curator Emeritus and Ornithologist, will accompany us. The

last group on this tour saw six of the few known condors in the wild. $45, including lunch and transportation.

THE ANCIENT ONES, August 30–September 3, 1985 (Labor Day Weekend) The picturesque bristlecone pines, the world's oldest trees, have been known to live as long as 7,000 years. Robert Gustafson, Assistant Curator of Botany, will lead us into the White Mountains to see these magnificent trees, which have been polished over the years by ice, wind, and sand. We'll spend one night in a mountain lodge, two at a research station, and the last in a country inn. Limited to twelve people. $525, including all meals, accommodations, and transportation by van.

Other California Natural History Tours include:
Santa Cruz Island Historic Ranch House, September 13–16
California's Ancient Sky Watchers, September 28
Apple Festival, October 5
Condor Watch, October 6
Pioneers, Indians, and the Giant Sequoia, October 12–14
Photographic Tour with Paul Slaughter to Owens Valley, October 18–21
A Haunting Weekend, October 26–28

We Want You . . .

. . . to be a volunteer! The Membership Office has many projects for enthusiastic and helpful people. If you'd like to get involved and help us make more people aware of the wonders of the Natural History Museum and the Page Museum, please call! We will talk with you and match your interests and energies with our various projects. Just call 213/744-3426 and ask about volunteer opportunities. Thank you!

MUSEUM DEVELOPMENT

Two New Councils Formed

In the last *Newsletter* the Automotive Collection Council was described in some detail, introducing TERRA readers to the concept of the Council as a program that provides ways for individuals interested in a particular aspect of the museum to further their knowledge of the subject in association with fellow enthusiasts and under the guidance of a curator. Councils also engage in activities in support of curatorial collection and research endeavors. Since then, the Gem and Mineral Council and the Bird Council have been formed. These councils and the Automotive Collection Council, which are open to all interested individuals, are actively seeking members.

Gem and Mineral Council

The Natural History Museum has one of the outstanding gem and mineral collections in the world, and the new Deutsch Gallery, Gemstones and Their Origins, is conceptually and physically the finest exhibit of its kind anywhere. The enthusiasm generated by its opening has stimulated interest in forming a council, and a founding Board of Directors is now working closely with Mineralogy Curator Dr. Anthony R. Kampf in formulating bylaws, establishing the goals of the council, and planning a schedule of activities. These will include seminars and lectures, visits to private collections and other exhibits, and travel to various gem- and mineral-rich locales throughout the world. Douglas J. MacDonald, a past president of the Museum Alliance Board of Directors and a current Research Associate, has been elected Council President.

Bird Council

The museum's Ornithology section has a large, scientifically significant collection, curated by Dr. Ralph W. Schreiber, and the Bird Council has been formed to support that collection. Council members will pursue the popular study of birds—bird watching, raising birds, and conservation—within the framework of ornithology as a scientific research discipline.

The Bird Council's aims are to:

- Provide individuals interested in ornithology with the opportunity to learn more about the discipline and
- Provide supplemental funding for operations and collection activities in the Ornithology section to carry out needed curatorial or research activities that would otherwise go unfunded or underfunded.

Alan G. Lowy, a member of the Alliance Board of Directors, is the Council President. Mrs. Jean Brandt and Jerry Jennings are Vice Presidents.

Currently each of the three museum councils has annual dues of $100. Further information may be obtained by calling Mike Bell at 213/744-3438.

EXHIBITS

Exhibit Openings

The Olympics Retrospective. Opening August 15.
Maya: Treasures of an Ancient Civilization. Opening September 7.

Continuing Exhibits

Natural History Museum
Animated Apatosaurus (Brontosaurus).
California Condors.
Insects of the Amazon Basin. Through October 1.
Megamouth.
Mushrooms Up and Down Los Angeles.
Recent Acquisitions: Pueblo Pottery. Through November 15.
Times of Trade. At 400 South Hope Street Building lobby, through October.
You Ain't Heard Nothin' Yet: Movie Posters at the Dawn of the Sound Era.
West Texas Cactus and Succulents.
Page Museum
Animated Woolly Mammoth.
Fossil Blocks with Articulated Skeletons. Fishbowl Lab.
36,000 Year-Old Hide of Extinct Steppe Bison.

EDUCATIONAL OPPORTUNITIES

1985 Adventures in Nature for Children

This summer the Natural History Museum will again be offering natural science workshops for children. In sessions particularly tailored to specific grade levels and designed to augment elementary school science programs, your child will encounter and learn more about nature first-hand by observing, handling, and working with animals, minerals, and fossils. The workshops will include many interesting activities and educational opportunities and will provide a basis for the life-long study and appreciation of the natural world.

The classes cost $35 per child for a four-day course. Classes are limited to twenty children and will meet each day from 10 a.m. until noon. There will be two sessions available, either Tuesday, July 23 through Friday, July 26, or Tuesday, July 30 through

Friday, August 2. Children should be registered for the grade level that they will have completed in June 1985. Adults may participate in discovery tours of the museum while their children attend the nature workshop sessions.

To enroll your child or children, send a check for $35 per child, made payable to the Museum Foundation, to the Education Division, Natural History Museum, 900 Exposition Boulevard, Los Angeles, CA 90007. Indicate child's name, grade level, and which of the two sessions you would prefer. Be sure to include your name, address, and day phone number. Call the Education Division at 213/744-3342 for more information.

Grade 1: Entomology. Catch a butterfly, make an insect model, and learn about insect identification in this introduction to the largest group of animals on earth.

Grade 2: Mineralogy/Geology. Handle rock samples, learn testing procedures for various minerals, and study erosion, mountain building, and other geological processes.

Grade 3: Herpetology. Stroke a live snake, touch a lizard, examine museum specimens, and learn the characteristics of reptiles and amphibians.

Grade 4: Ichthyology. Hatch fish eggs, make fish prints, and learn about the diverse strategies fish have for surviving in their aquatic habitat.

Grade 5: Ornithology. Study the structure of feathers under a microscope, examine the physical modifications that enable birds to fly, and learn to recognize the adaptations of various birds to their habitats.

Grade 6: Paleontology. Examine many kinds of fossils, learn about plants and animals that lived hundreds of millions of years ago, make your own fossil cast, and visit the museum's paleontology laboratory in this introduction to prehistoric life.

Page Museum Summer Classes

This summer the Page Museum offers four classes to children who are between 1 and 15 years of age. Running from July 30 to August 2 is a class on La Brea Mammals and one on Our Changing Earth. From August 6 through 9 a class will be offered on Dinosaurs and another surveying the changes From Mouse to Man. Classes run all day, from 10 a.m. to noon and 1 to 3 p.m.

These classes are open to the children of members and the cost is $35 per child per class. For more information call Barbara Parkhurst at 213/857-6305.

Free Films and Gallery Tours

In July and August the Tuesday film and gallery tour program will explore the exotic animals of Africa, giving special attention to the newly opened Okapi habitat. The films will begin at noon in the Jean Delacour Auditorium, and tours will start at 1:30 p.m. at the north entrance of the museum.

July 2, 1985 ***Film***
Born Free Color 95 minutes
Photographed on location in Kenya, this film tells the famous story of Elsa the lion, raised from a cub by George and Joy Adamson and returned to the wild as a mature lioness. Bill Travers and Virginia McKenna portray the Adamsons.

August 6, 1985 ***Film***
Mzima: Portrait of a Spring
Color 53 minutes
This excellent documentary by Alan and Joan Root is a study of animal life in and around Mzima springs in southern Kenya's Tsavo National Park. Underwater shots of crocodiles, hippos, snakes, and otters are featured.

July 2 and
August 6, 1985 ***Tour***
African Mammals. The museum's exhibits include some of the finest wild animal displays in the world. Join us on a safari through the African Mammal Hall where we will learn about the elephant, lion, hippo, hyena, chimpanzee, rhinoceros, and the shy and elusive okapi, which has recently been placed on display in the hall.

Free Films at the Page Museum

The Page Museum is open free of charge on the second Tuesday of each month, and admission to screenings of special films is also free on that day. On July 9 ***Connections: The Long Chain*** will be shown. James Burke explains how materials discovered by accident can alter the course of the world, in this case the sequence of discoveries leading from coal tar to the first modern plastics. It all started in the 1700s with a search for a substitute for pitch to waterproof British frigates. ***Connections: Eat, Drink, and Be Merry*** will be screened on August 13. Napoleon's need for stored provisions led to the preservation of sterilized food in empty champagne bottles, an idea later modified by the British, who used tin cans to store food.

GENERAL INFORMATION

The Natural History Museum, located at 900 Exposition Boulevard, Exposition Park, Los Angeles, California 90007, is open from 10 a.m. until 5 p.m., Tuesday through Sunday. The museum is closed Mondays, Thanksgiving, Christmas, and New Year's Day. Admission is $1.50 for adults and $.75 for students and senior citizens; children under 5 are admitted free. Admission is free on the first Tuesday of each month. For further information on museum activities and future events, please call the Membership Office, 213/744-3426.

The Page Museum of La Brea Discoveries, located at 5801 Wilshire Boulevard, Hancock Park, Los Angeles, California 90036, is open from 10 a.m. until 5 p.m., Tuesday through Sunday. The museum is closed Mondays, Thanksgiving, Christmas, and New Year's Day. Admission is $1.50 for adults and $.75 for students and senior citizens; children under 5 are admitted free. Admission is free on the second Tuesday of each month. For further information, please call 213/857-6311.

Tender, green, immature fruits of the pink-flowered devil's claw (P. parviflora) *resemble beanpods.*

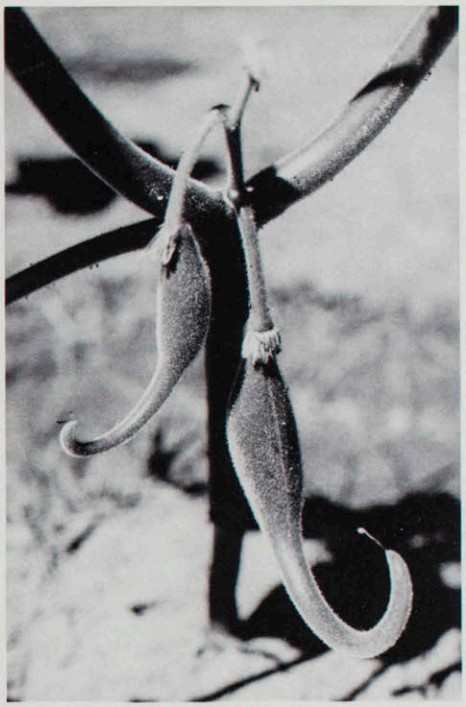
beanpods or okra. They are cultivated in gardens by some Arizona Indian tribes and are cooked and eaten as a vegetable. When I have cooked them I have found them quite unpalatable, but perhaps I have not prepared them in the right way or used enough seasoning. In some parts of the United States they are grown and pickled like cucumbers, either alone or with other vegetables. Since our southwest devil's claw plants are not abundant and because they are easy to grow, it is perhaps more ecologically sound to grow your own plants rather than harvesting them from wild plants if you desire quantities of seedpods.

Indians have long used and highly prized the large-fruited, pink-flowered annual, *P. parviflora*. A white-seeded race, with twelve-inch seedpods and enormous black claws up to nine inches long or longer, is cultivated by the Papago Indians in Arizona for use in basketmaking. The baskets are well known for their durability, beauty, and intricate design. The four basic colors in the baskets are white, black, green, and red. White comes from sun-bleached, dried yucca leaves, while green is from unbleached, dried leaves. A red dye obtained from yucca roots is sometimes used to color the leaves, which are tightly wound around slender, fibrous bundles of beargrass leaves (often *Nolina microcarpa*) producing the unique coils of the baskets. The black color is supplied by the devil's claw.

When dried, the devil's claw seedpods look as though they were sprayed with flat black paint. These dried pods are soaked in water, then the long, curved claws are split lengthwise into two narrow strips. The pliable black strips (like leather shoelaces) are tightly coiled around bundles of beargrass leaves to produce the dark patterns. Since the black color is part of the actual pod and not a dye, it will last indefinitely. The elaborate designs obtained by alternating strands of white yucca leaves with black devil's claw pods make for a striking contrast.

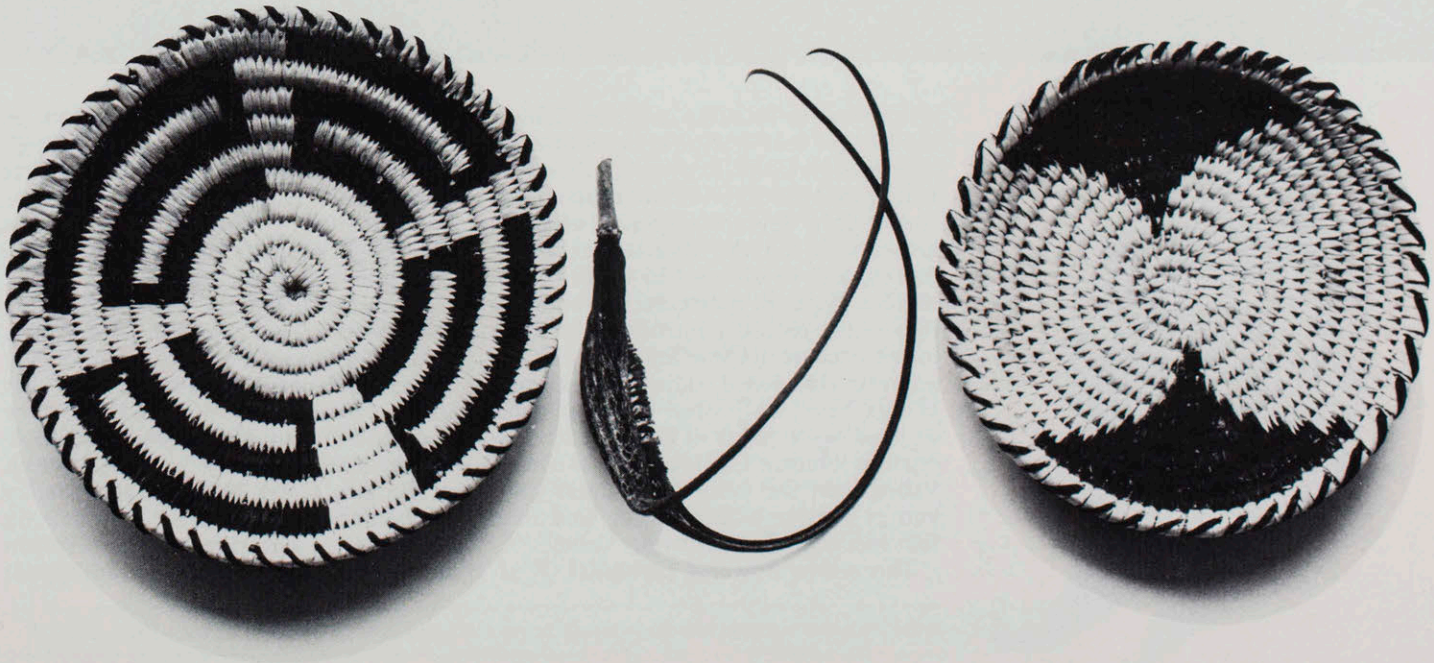
Other tribes of southwest Indians, such as the Pima, Havasupai, Apache, Yavapai, Chemehuevi, Hopi, Shoshone, and Paiute, also use strips of devil's claw for black designs in their baskets. Depending on the tribe and availability of plant materials, strips of stems from willow *(Salix)*, cottonwood *(Populus)*, rush *(Juncus)*, or squaw bush *(Rhus trilobata)* are used in place of yucca leaves, and strips of stems from cattail *(Typha)*, tule *(Scirpus)*, or willow are used in place of beargrass leaves. In *The Basket Weavers of Arizona* (1954) Bert Robinson describes a plausible origin for devil's claws in Pima basketry:

> In all probability, the first baskets made by the Pimas were woven entirely of willow or cottonwood, but the sharp sand around the cooking fire soon cut out the stitches on the surface exposed to the ground, especially if the basket were heavily laden. It is possible the ancient basket weaver, seeking something that would withstand more wear, found that the devil's claw, which fastened itself about her ankle as she walked through the fields, possessed the strength and toughness she was looking for.



Both native species of devil's claw are

Papago baskets and dried seed capsule of P. parviflora. *The white patterns are from dried, sun-bleached yucca leaves. Narrow strips from the claws of the seed capsule are used for the striking black designs.*



A cluster of P. louisianica *buds and blossoms. The large flowers are light pink with reddish-purple dots and streaks of bright yellow. This species of devil's claw is occasionally naturalized in the southwestern United States.*

widespread in Arizona and Baja California but are less common in California. The pink-flowered *P. parviflora* used by Indian basketweavers is common in Arizona's Gila River floodplain, where it grows wild on the riverbanks, along fences, and in abandoned fields where there is plenty of moisture. It is thought that it was probably introduced in California because its few known locations are near abandoned Indian settlements. It has been collected from several isolated desert areas of Inyo County, including Johnson Canyon west of Death Valley, near the mouth of Hunter Canyon in remote Saline Valley, and near Fort Independence in Owens Valley.

The yellow-flowered perennial *(P. altheifolia)* grows from a deep taproot in dry washes and along roadsides through the Colorado Desert, including several areas within Anza-Borrego Desert State Park. It is not commonly seen because few people botanize these regions in the scorching heat of late summer.

Certainly one of the most fascinating locations for *P. parviflora* in California is Johnson Canyon, a steep canyon on the eastern side of the Panamint Range that drains into Death Valley. It can be reached from the graded West Side Road, approximately twenty-five miles south of Furnace Creek Inn. A steepy, rocky road climbs the alluvial fan for about six miles before entering Johnson Canyon for another three miles. The road stops at

Showy flower of the native perennial devil's claw (P. altheifolia). *The corolla is brilliant yellow with flecks of reddish-brown and streaks of deep yellow. Note the dense glandular hairs on flower bud and pedicels.*

a cool spring and the site of an old corral surrounded by cottonwood trees and willows. From here the historic canyon narrows, and a foot trail continues up the canyon to Hungry Bill's Ranch and beyond to the crest of the Panamint Range.

Panamint City, located about five miles to the west of Johnson Canyon, was a rough and wild little silver-mining town with a population of several thousand people in the mid-1870s. Hungry Bill was a tall Shoshone Indian with a reportedly enormous appetite, and he settled in Johnson Canyon after the breakup of Panamint City.

Prior to Hungry Bill's settlement, the upper Johnson Canyon bottom was cultivated by several Swiss people who raised fresh vegetables for bustling Panamint City. According to Dr. Edmund C. Jaeger (writing in *Desert Wildflowers*, 1941), Hungry Bill's brother visited Fort Mojave, Arizona, and found the Indians there making black designs in their baskets with devil's claw pods. He brought seeds back and planted them in Johnson Canyon, where they became naturalized and still—a century later—flourish.

Wayne P. Armstrong is Professor of Biology at Palomar College in San Diego County. He has written for Pacific Discovery, Madroño, Environment Southwest, *and* Fremontia. *His research interest is the taxonomy of the Lemnaceae (duckweed) family.*

The dried seed capsule of Martynia annua *resembles the skull and upper jaw of a pit viper.*

OLYMPICS DÉJÀ VU

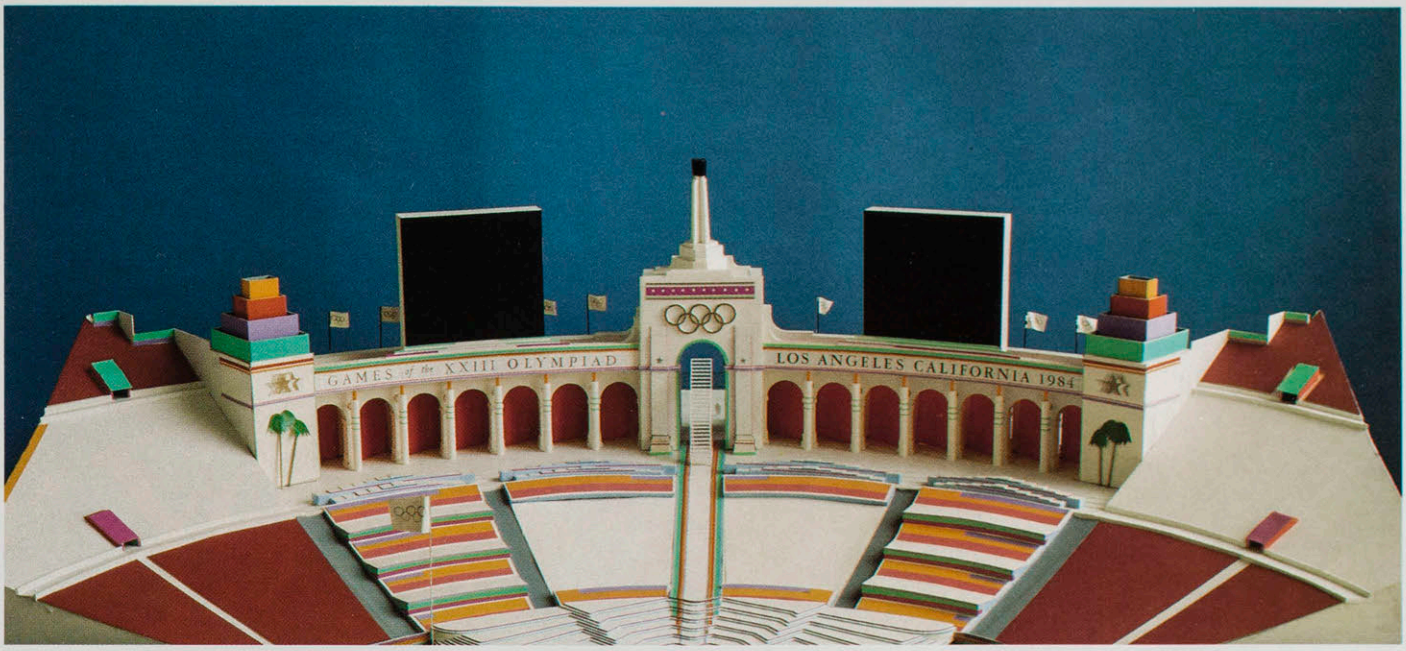
John DeLeon

Natural History Museum Curatorial Assistant John Cahoon models his volunteer's uniform in front of the Coliseum. (The pins are not part of the standard issue uniform.) John worked as a Volunteer Host for the LAOOC welcoming visiting teams, officials, and dignitaries at the airport and helping them through customs, immigration, and the accreditation procedure.

Natural History Museum visitors will be able to experience the pageantry and excitement of the Games of the XXIIIrd Olympiad when a new exhibit featuring this spectacle opens in August. This show celebrates last summer's Olympic Games in Los Angeles, including the cross-country torch relay and Olympic Arts Festival performances and displays. Composed of objects donated to the museum by the Los Angeles Olympic Organizing Committee (LAOOC), film footage from the American Broadcasting Corporation, and related materials from other sources, the exhibit will pay tribute to the athletes, artists, and others who participated in the many events associated with the 1984 Games.

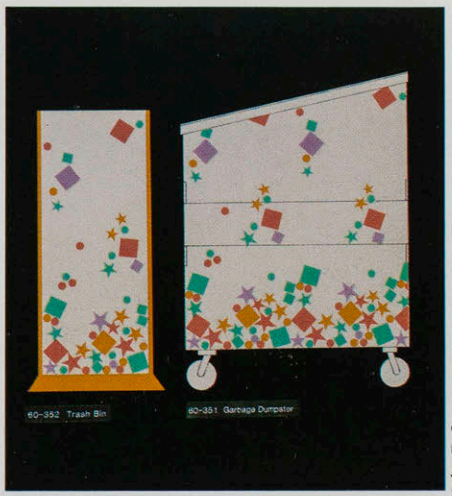
Visitors will be welcomed to the exhibit as they pass through a colorful gateway proclaiming the Olympic motto "Citius, Altius, Fortius" (Faster, Higher, Stronger) and proceed through three major sections. The first provides a historical perspective of the modern Games from 1896, featuring the 1932 Los Angeles Olympics, and includes a large U.S. map depicting the route of the torch relay. The next section centers on the athletic and arts events of 1984, featuring sports equipment and arts materials. The finale includes displays of Olympic memorabilia, computer terminals offering information about athletes and events, and a video of the closing ceremonies.

The exhibit's multimedia approach is intended to re-create the sights, sounds, and atmosphere of the Games. Three-dimensional objects include architectural elements such as decorative tents and entryways found at the sites of Olympic events; models of athletic contest venues and Robert Graham's Olympic Gateway sculpture; an awards platform and medals; a relay torch; and



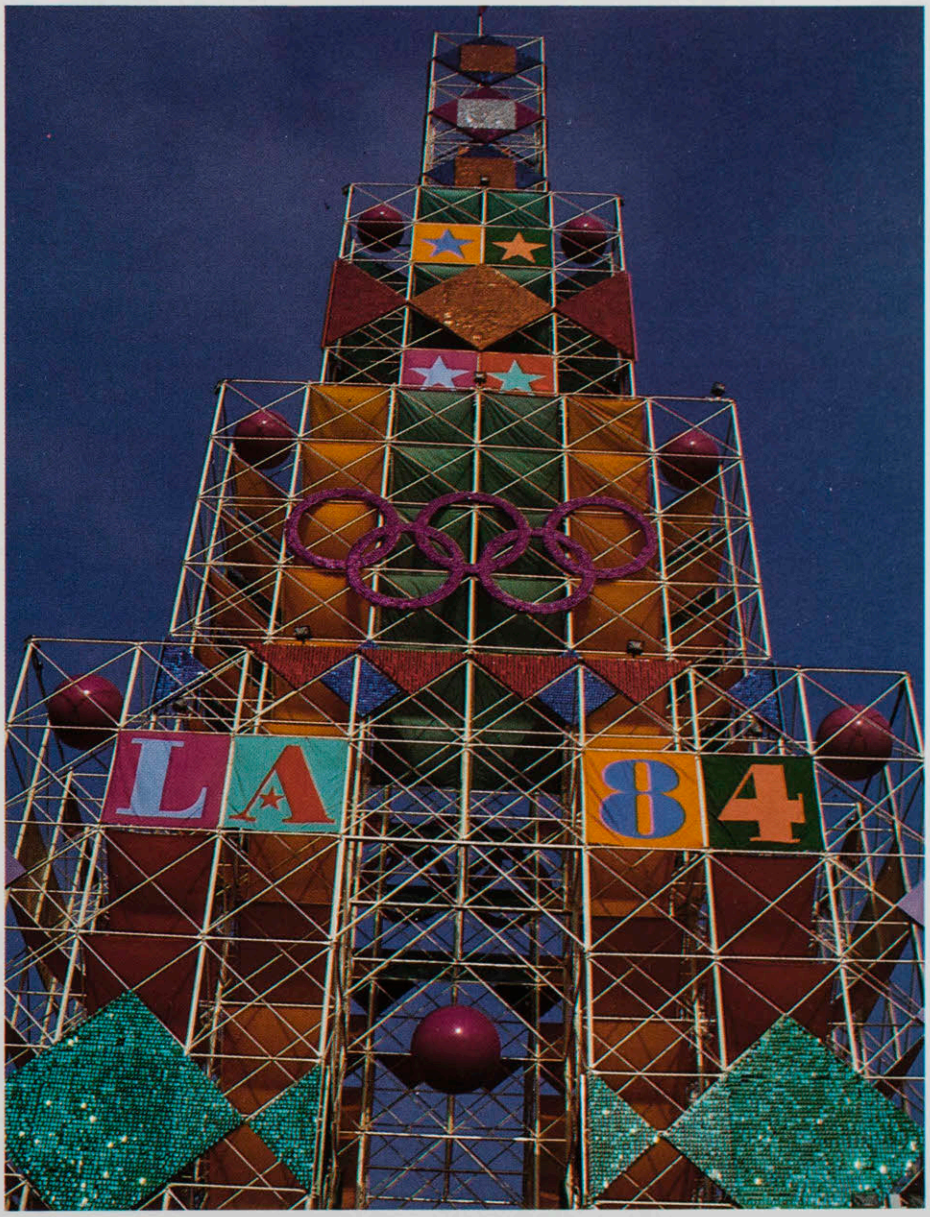
Susan Gipson

Above and center: These mockups of the Coliseum (a two-foot tall model shown here) and an Olympic trash bin and garbage dumpster were used by LAOOC planners to illustrate colors and scales of decorations.



John DeLeon

Right: The dazzling Exposition Park gateway to the Olympics.



John DeLeon

trading pins. Photographs, drawings, and posters of athletes, contests, and artworks are only a few of the illustrations included in this show. Throughout the exhibition, videos of competitions and ceremonies, as well as tape recordings of the athletes and other participants, will enhance the objects on display. Visitors will be encouraged to touch certain exhibit materials such as a replica of the Coliseum's artificial track, gymnastics flooring, and a balance beam at floor level.

The 1984 Olympics Retrospective Exhibit will open August 15 and run through November 17, 1985.

Tom Sitton
Assistant Curator, History

A gold medal from the museum's collection.

John DeLeon

Susan Gipson

The LAOOC donation to the museum included copies of the daily newspaper, The Olympic Record, *published by the LAOOC for Olympics visitors; programs for the opening ceremonies and official souvenir programs; RTD bus maps; a totebag issued to LAOOC staff; a flashlight of the kind used by the audience in the closing ceremonies; and a pair of running shoes supplied to Olympic Torch Relay runners.*

Dick Meier and John De Leon

One of the many torches provided by the LAOOC for the cross-country torch relay.

"You ain't heard nothin' yet"

MOVIE POSTERS AT THE DAWN OF THE SOUND ERA

Almost as soon as moving pictures were developed, inventors tried to find ways to make them talk. For instance, in 1894 Thomas Edison added earphones to some of his peep show Kinetoscopes. These and other efforts proved unsatisfactory, however, and it was not until the late 1920s that sound technology had improved enough so that talking, singing, and orchestrated pictures could achieve commercial success.

In 1926 Warner Brothers, in search of a gimmick to save their financially troubled company, produced *Don Juan*, a feature starring John Barrymore, with musical accompaniment recorded by the New York Philharmonic Orchestra. In 1927 the same studio brought out *The Jazz Singer*, in which Al Jolson uttered the memorable words, "You ain't heard nothin' yet." Despite the predictions of such men as Carl Laemmle, president of Universal Pictures, who felt that silent pictures would never be replaced, the public demand for talkies was so great that the studios soon abandoned the silent film altogether. The turning point came in 1929—in that year the studios produced 505 features with sound and only 175 that were completely silent.

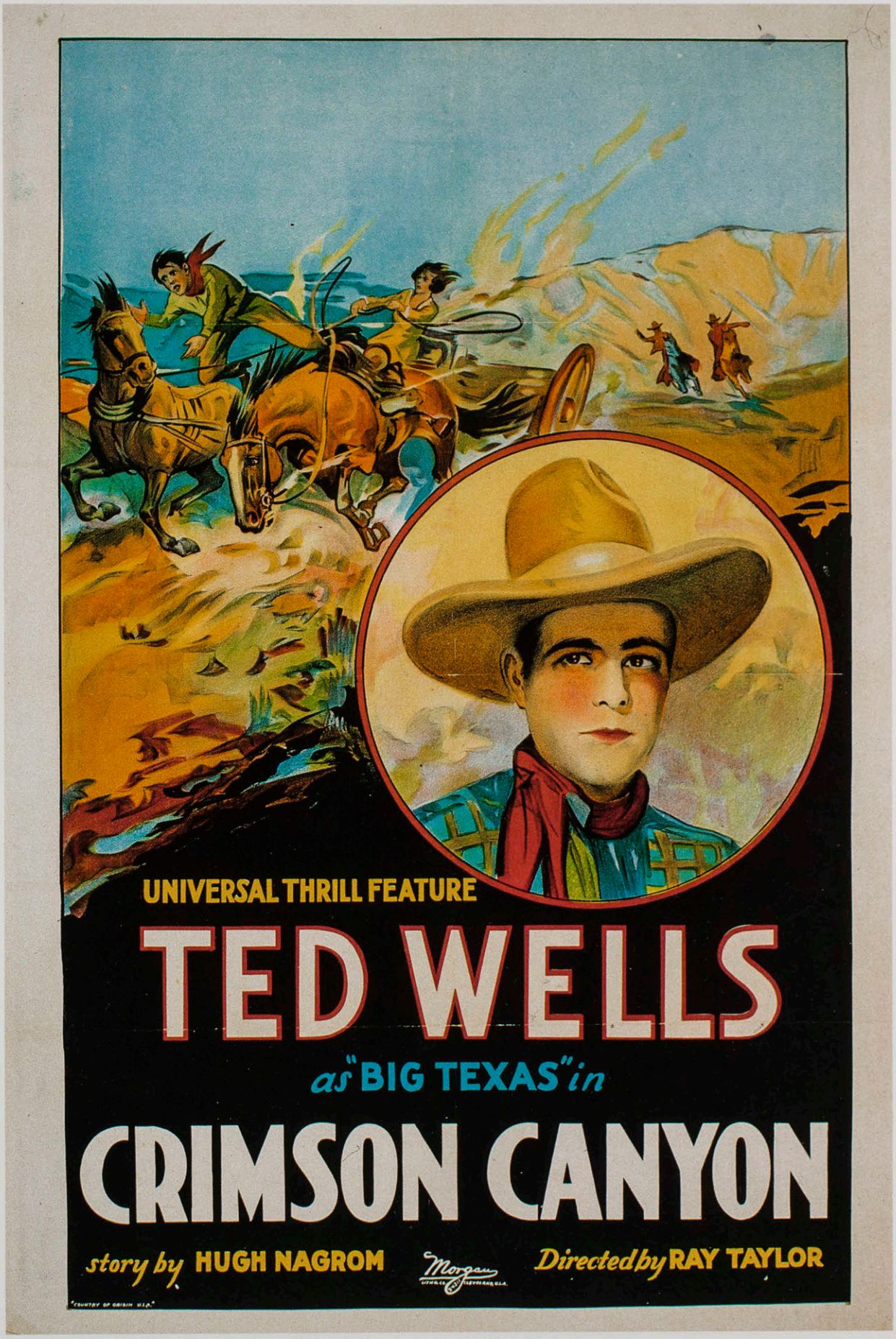
Forty lobby posters—most of which date from that crucial year 1929—illustrating the transition from silent movies to talkies are featured at the Natural History Museum. The exhibit, You Ain't Heard Nothin' Yet: Movie Posters at the Dawn of the Sound Era, will be on display through November in the ground floor changing gallery. The posters on these pages are a sampling from the exhibit.

Errol Stevens
Associate Curator, History

Betrayal *(1929—Paramount Pictures). This drama, about a love triangle involving a bohemian artist (played by Gary Cooper in one of his first roles), the mayor of a Swiss town (Emil Jannings, Germany's leading cinema actor of the 1920s), and his young wife (Esther Ralston), was released as a silent feature and also with synchronized sound effects.*

Crimson Canyon *(1928—Universal Pictures). A silent western in which "Big Texas" (Ted Wells) saves Daisy —a girl, not a horse—from the bad guys.* ⇨

JOIN TWO GREAT MUSEUMS


UNIVERSAL THRILL FEATURE
TED WELLS
as "BIG TEXAS" in
CRIMSON CANYON
story by HUGH NAGROM
Directed by RAY TAYLOR
Morgan
"COUNTRY OF ORIGIN U.S.A."

Her Private Affair *(1929—Pathé). This story of marital discord, murder, and blackmail featured talking sequences and sound effects.*

Harvest of Hate *(1929—Universal Pictures). Rex, the horse who starred in twenty-eight films between 1921 and 1930, receives top billing in this silent western.*

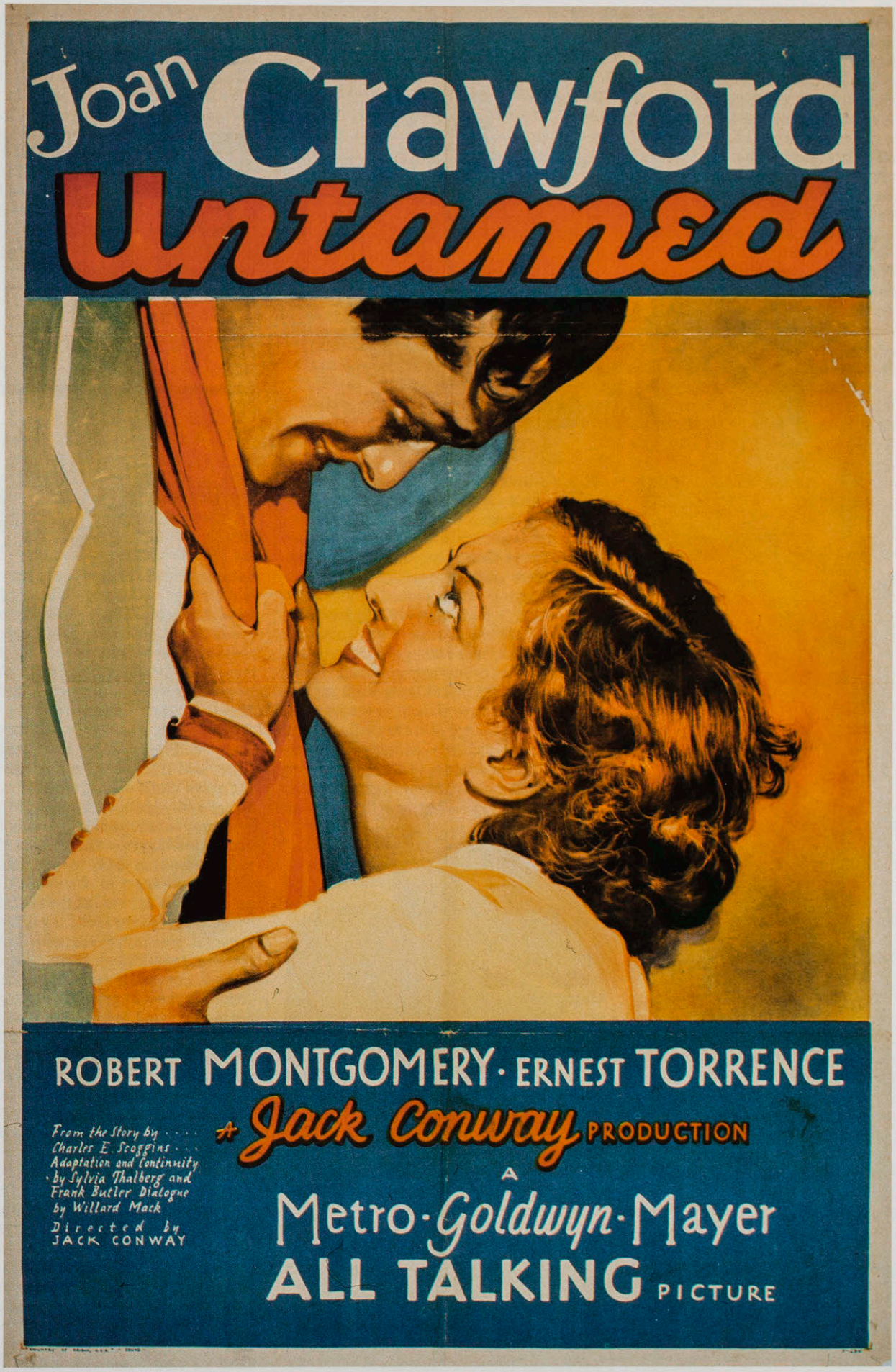
A UNIVERSAL THRILL FEATURE
Rex
KING OF WILD HORSES
with
JACK PERRIN
and his wonder horse "STARLIGHT" in
The HARVEST OF HATE
Story by WILLIAM LORD WRIGHT & GEORGE H. PLYMPTON
Directed by HENRY MacRAE
COUNTRY OF ORIGIN AND PRODUCTION U.S.A.

PATHÉ
presents
Morgan
ANN HARDING
in
Her Private Affair
By Herman Bernstein
Directed by Paul Stein
ALL MUSIC · ALL SOUND · ALL DIALOGUE
PATHÉ PICTURE

Screen's Greatest Comedian in the Laugh Epic of His Career!
William Le Baron PRESENTS
CHESTER CONKLIN in TAXI 13
Martha SLEEPER
Hugh TREVOR
FROM THE STORY BY W. SCOTT DARLING
DIRECTED BY
MARSHALL NEILAN
FBO PICTURES CORP.

Taxi 13 *(1928—FBO Pictures). A part talkie about a poor taxi driver (Chester Conklin, formerly one of the Keystone Kops) who catches some thieves and buys a new taxi with the reward money.*

Untamed *(1928—MGM). In this film, released both in talking and silent versions, Joan Crawford plays Bingo, an uncultured girl who acquires polish in New York City and also wins her man.* ⇨


Joan Crawford
Untamed
ROBERT MONTGOMERY · ERNEST TORRENCE
From the Story by Charles E. Scoggins
Adaptation and Continuity by Sylvia Thalberg and Frank Butler Dialogue by Willard Mack
Directed by JACK CONWAY
A Jack Conway PRODUCTION
A
Metro-Goldwyn-Mayer
ALL TALKING PICTURE

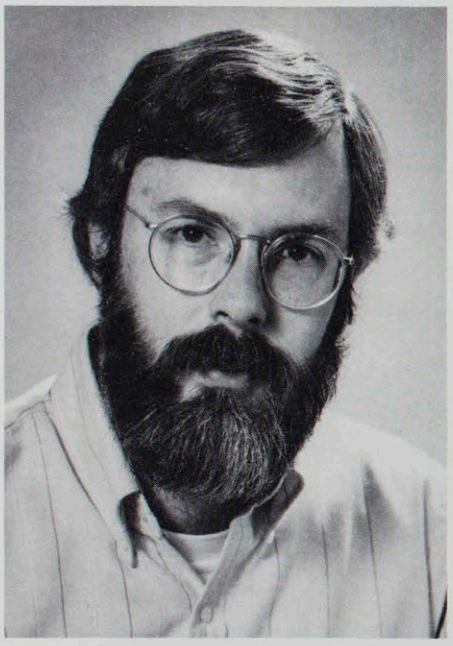
(Continued from page 2)

discussed in Washington, D.C. and throughout the nation. This is a proposal to survey and catalog all the animals and plants that occur in the United States.

The National Biological Survey would produce the first computerized list of all the animals and plants that are found in the United States and would include distributional information. It is a massive project, and is so large that it would probably require a special act of Congress to fund it over ten to fifteen years.

The Natural History Museum was fortunate to have been the site of the first public forum on this topic. Speaking at the symposium were prominent scientists and public officials from all over the United States, including representatives of the Senate Committee on Environment and Public Works, Environmental Protection Agency, Nature Conservancy, Oak Ridge National Laboratory, the U.S. Department of Agriculture, the U.S. Department of Interior, and the Smithsonian Institution.

GEORGE L. KENNEDY



Dr. George L. Kennedy has joined the staff of the Natural History Museum as Assistant Curator in the Invertebrate Paleontology Section. A native of San Diego, Dr. Kennedy completed his Ph.D. at the University of California at Davis in 1978 and was a geologist with the U.S. Geological Survey at Menlo Park before coming to the museum. He specializes in the study of Late Cenozoic mollusks of western North America and is particularly interested in dating and paleoclimatic aspects of Pleistocene marine terrace faunas. His numerous scientific papers are based in part on collections he has made from Baja California to arctic Alaska.

NATIONAL ENDOWMENT FOR THE HUMANITIES GRANT

Dr. Guy Bishop has received a grant from the National Endowment of the Humanities to support field research on nineteenth-century Mormon social history. In connection with this research, he has recently read papers at professional meetings of the Mormon History Association (Independence, Missouri, May 2–5) and the Pacific Coast Branch of the American Historical Association (Stanford, June 26–28).

MINING ARTIFACTS DONATED

The Business and Industrial Section of the History Division has received a donation of important California mining artifacts from Mr. Don Dickey, Dickey Exploration Company, Alleghany, California, that greatly augments the division's mining collection. The donation includes a Berdan pan dating from the turn of the century used by California gold miners to separate gold from quartz and other gold-bearing material. Other artifacts in the Dickey collection include a variety of tools and implements used in the early days of California mining. Dr. Peter Keller recently added to the museum's collection of mining items by donating some rare mining lamps.

A Berdan pan, donated by Mr. Don Dickey. This pan grinder and amalgamator was invented by Hiram Berdan, later a famous Civil War officer, soldier of fortune, and firearms inventor. Berdan pans were in use from the 1850s until World War II. Two 75-pound balls crushed gold-bearing quartz; the quartz was sloughed out with water, while the gold amalgamated with mercury that had been added to the mixture and sank to the bottom. (Photo by John De Leon)

CORRECTION

Several readers have noticed an error in "Recent Acquisitions: Pueblo Pottery" (TERRA, March/April 1985). In the photograph at the top of page 26, Severa Tafoya is shown applying red slip to the surface of a bowl, not building a vessel by adding a coil as the caption states. The museum's exhibit of Pueblo pottery acquisitions incorporates photographs of the potter coiling and slipping pots, and the caption on coiling was inadvertently used with the photograph of the slipping operation in the TERRA article.

BOOK REVIEW

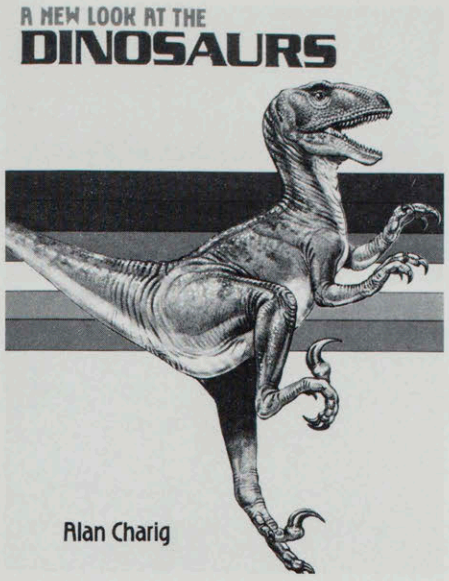
A NEW LOOK AT THE DINOSAURS BY ALAN CHARIG

FACTS ON FILE, NEW YORK 1985
160 pp. Cloth $15.95, Paper $9.95

For an adult, especially one like me who is supposed to be a paleontologist, buying a book on dinosaurs takes a certain amount of courage. Seemingly every child in the nation can recite at will a long list of multisyllabic dinosaur names, spell them correctly, and provide details of each creature's vital statistics on demand. Buying a dinosaur book, then, becomes rather a traumatic experience, and one excuses the purchase to the sales clerk by mumbling something about how this looks just right for one's little nephew. I imagine this is like buying a book on sex—one doesn't want the next person in line to know one isn't already an expert in the subject. So I was delighted to be excused this trauma by being asked to review Charig's book. For those of you out there who had similar reservations, I have good news for you. This is an adult book in the original sense of the word, and you may buy it with your head held high!

I had wanted to read this book for a long time. Alan Charig, Curator of Fossil Amphibians, Reptiles, and Birds at the British Museum (Natural History), has the reputation of being a witty but authoritative spokesman for his field; his book had been well received by his fellow professionals; and it had been used as the guidebook for what had been promoted as Britain's best exhibition on dinosaurs. (This was not, as readers of *Nature* may have noted, at the British Museum of Natural History!) I am glad to report that the book lived up to the impressive reviews on its back cover.

The author is aware of the many misconceptions about dinosaurian matters that we nonspecialists share. "Many of



my readers will be intelligent people with a wide range of interests and a great deal of knowledge on other subjects. Yet I have found that people like that often manage to perform the remarkable feat of going through life without acquiring any real information on dinosaurs—just as I, by contrast, have managed to learn very little of anything else!" Charig attempts to remedy this deficiency in his readers by conducting a comprehensive, balanced, and sometimes slightly irreverent survey of the world of dinosaurs. He manages, without compromise to his science or condescension to his audience, to share both his knowledge of and his enthusiasm for his subject.

The first chapter is devoted to resolving exactly what a dinosaur was. Not, apparently, any large and extinct creature with an unpronounceable name but only those terrestrial reptiles with a "fully improved" posture. This fact alone is worth the price of the volume and will enable the reader to lord it over those less-informed precocious brats with the prodigious memories. The second chapter, a brief discussion of our changing world, concludes with the statement, comforting to some but provocative to others, that there is no real conflict between science and religion.

The next sixty pages provide an uneven survey of topics that contribute to a better understanding of the nature and diversity of this fascinating group of animals. The treatment of the more "academic" concepts—fossils and time, the evolutionary tree, principles of classification—is certainly competent. However, these chapters lack the inspiration of those representing immediate ramifications of the main theme—how dinosaurs were fossilized, the first discoveries, hunting for dinosaurs, dinosaurs as living animals—in which the author's enthusiasm becomes infectious. The reader is cautioned that "hunting dinosaurs, like hunting lions or elephants, can be dangerous. Not, of course for the same reason...." and is instructed how to estimate the weight of a dinosaur—a somewhat less risky business—and how to interpret dinosaur tracks. The author's curatorial background surfaces on occasion with wry statements such as: "Mounted dinosaur skeletons are very useful objects for filling museum galleries—partly because they take up a great deal of room, partly because they attract vast numbers of people who come to marvel at their gigantic size and strange appearance." This portion of the book is concluded by chapters on the classification of dinosaurs, in which we learn the basis for sorting these beasts into related groups, and a discussion of dinosaur origins that includes a detailed account of how, and perhaps why, they were the dominant land-dwelling animals for more than 100 million years of the Mesozoic era.

It is not until two-thirds of the way through the book, "after," as the author admits, "what may have seemed like endless preliminaries," that we reach "the straightforward descriptions of the different sorts of dinosaur." These comprise concise portrayals of the major types; sesquipedelianists and readers who may have feared this was a cursory survey are reassured that "those not described may be safely regarded as merely variations on a theme."

The final section of the book treats four topics of recent and continuing interest. Arguments for and against dinosaurs being warm-blooded are fairly evaluated with the point made that the same evidence has been used by both sides to "prove" their opposite points of view. A discussion of the relationship between birds and dinosaurs ends in a caution against premature reclassification with its resulting absurdities ("see the humming-dinosaurs lightly flitting from flower to flower"). The geographic distribution of different types of dinosaurs is explained in light of a sequence of changes in the disposition of the continents and oceans. The book concludes with the almost obligatory discussion of why dinosaurs became extinct. Many of the different explanations for dinosaur extinction are examined, including the Alvarez's widely publicized asteroid-collision theory, although not that of Will Cuppy: the Age of Reptiles ended because it had gone on long enough and was all a mistake in the first place.

This authoritative popular survey of dinosaurs is, despite its British source, truly international in scope. It is profusely illustrated throughout; restorations of the different kinds of fossil reptiles, mainly in black and white but some in color, are of the high standard expected of the British Museum (Natural History). Photographs of fossils and of field and laboratory work in progress are well chosen. The engaging and stimulating text, though geared to the adult reader, can be read in a couple of hours or so; I predict, however, that the reader will be inspired to dip into its pages again and again.

The late George Gaylord Simpson, doyen and mentor of the paleontological profession, viewed Charig's book as definitely the best of many that have been written about dinosaurs. I agree. Buy it!

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